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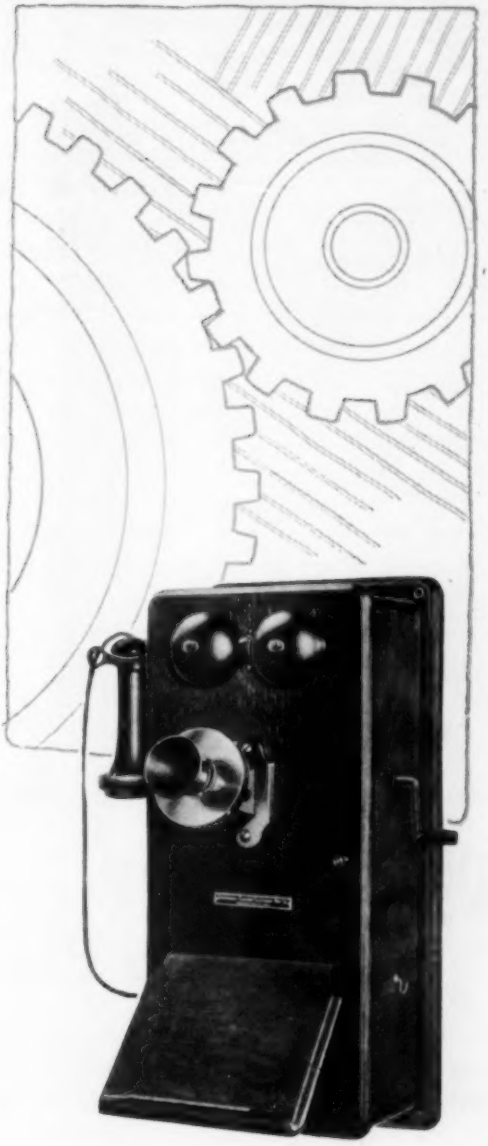

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Telephone Engineer

Volume 32 OCTOBER, 1928 No. 10

The Subscriber-Owned P. B. X.

Ordinarily it is assumed that the only telephone companies having difficulties about subscriber owned equipment are the smaller ones who have to deal with farmer owned service lines. The same problem exists in a different form in many cities, particularly those which have Independently owned companies or where the Bell company has acquired former competing properties. We refer in particular to the subscriber-owned private branch exchange.

Independent companies in the past seldom had a fixed rule in dealing with this class of service and if a large factory or hotel installed its own equipment, frequently a contract for connection with exchange trunk lines was made. Trunk connections were often made to a variety of smaller p.b.x. switchboards and intercommunicating systems of various makes. While the equipment was new service was reasonably satisfactory but it soon deteriorated as the equipment suffered the various ills that come from unskilled or neglected maintenance.

As many of the contracts were made under competitive conditions and were very favorable to owners of such equipment, it became a difficult problem to induce them to surrender the connection and take service over equipment owned by the telephone company. Even after rate cases with their many ill-adjusted, flat percentage increases, were the subscriber owned private branch exchanges left in the position of being favored by more advantageous charges than were company owned subscribers.

A further difficulty in eliminating this type of service is the fact that the equipment is frequently of obsolete type or inferior quality and the telephone company has not felt justified in purchasing it from the subscriber at anywhere near the price the subscriber originally paid and which he still considers to be the value of the property. So the privately owned branch switchboard still exists and the telephone company has service difficulties very similar to those of the small exchange with farmer owned lines.

Arrangements whereby the telephone company maintains the equipment are only a partial solution of the problem either from the service or the cost standpoint. The only real solution is the ownership and maintenance of the equipment by the telephone company even if it involves the purchase of useless or deteriorated material at more than its real value from an operating standpoint. The manager who has taken over his last case of subscriber owned branch exchange equipment may well congratulate himself that he has relieved one more of the difficult operating problems of his company.

Have We Passed the Peak?

Inquiries among telephone men and other information we can gather, indicate that the last two or three months have seen a marked decrease in the number of people going about the country trying to interest telephone owners in selling their properties. There are still changes in ownership being made but most of them are on contracts or options given several months ago. The situation gives rise to the question: Have we passed the peak of the market for telephone properties?

The passing of the peak will cause various emotions for those who are interested in telephone property when that time comes. To the man who has been willing to sell but has been holding on for the highest possible dollar of price, it will mean opportunity gone and the necessity of holding on for a period of years or sale at a lower price than he might have obtained. To the man who bought high and expected to sell higher it will probably mean loss of sleep and possible loss of not only his prospective profit but some of his own capital and that of his associates as well.

To the man who bought high with the expectation of profit from operation, it means years of hard work to develop the property and its earnings under an overload of capitalization. To the man who bought at a reasonable figure it will mean opportunity to develop his business with a mind free from the uncertainty that arises from changes in ownership of neighboring properties.

To the man who has not been stampeded into

selling by the offers of large apparent profits, it means the opportunity to go along in the operation of his property with the assurance that he is reasonably safe from financial difficulties that arise from lack of conservatism in capitalization and with the hope that the public having become accustomed to telephone securities as an investment may come to distinguish good from bad securities. His own securities being good, he then may have a source of funds to enable him to develop his property to the highest possible standards. Such a one is in the best position of all to make real profits in the long run.

Opportunity to Survey the Territory

As this is being written, plans are being perfected for the annual meeting of the United States Independent Telephone Association, the convention of the Independent group in the telephone industry. Visitors from Maine to California and from Canada to Texas will gather at Chicago on October 16 to 19 to renew acquaintanceships and to discuss the problems of the industry. All the principal manufacturers and suppliers of telephone materials and equipment will be represented in the exhibit rooms.

Foremost in interest among the topics of discussion both in the meetings and outside will be the changes that have come in the Independent telephone industry due to the sale and purchase of many properties and the grouping of smaller units into larger groups through consolidations. The Independent industry is undergoing a rapid change from a large number of comparatively small units into a smaller number of companies each operating a considerable number of exchanges. Naturally all who are interested in Independent telephony are concerned as to how far this grouping is likely to go and what effect it is likely to have upon the industry as a whole.

The convention with its contacts with men from every part of the country offers an opportunity for a survey of the situation that no one in his own territory may have. For this reason many are likely to attend who otherwise might not come. Not only because of the many good things that will be on the program but also on account of the opportunities of meeting other men in the industry, both men of long service and new comers; of seeing new developments in the art and getting a bird's eye view of the development of the industry, will the convention be one that no Independent telephone man can afford to miss.

How Will Television Be Used?

Television continues to be a subject of much popular interest, aroused in part by the activities of radio broadcasters in experimental transmission by radio. To what extent it may be developed as a commercial service is still a question. It is likewise a question as to whether, in its final form, it will in the main make use of wire or radio transmission. The original demonstrations of the Bell Telephone Laboratories showed that it might make use of either medium. The nature of the services that may be developed and the economic factors will probably control the selection of the medium of transmission, although the fading of signals in radio transmission presents a difficulty that is as yet unsolved.

In time, television will take its place with the telegraph, telephone and telephoto services and will find its field of application. The dream of a television receiving set attached to every telephone and every radio receiver may be a long ways from realization but, ultimately, the service is sure to be found in the places where the need of such service is demonstrated. Being of the nature of a communication service, it must be co-ordinated with the other communication services and the telephone industry will, no doubt, have a large part in the furnishing of the service when it finally developed to the commercial stage. The fact that the Bell Telephone Laboratories has been a leader in its development is assurance that further development will not ignore its relation to the present commercial communication services.

"Penny-Wise, Pound Foolish"

"It seems to me that some telephone companies could save quite a lot of money by putting up their lines without using insulators" was a rather startling statement made recently by the general manager of a large company. As we had always been taught that good insulation was necessary, we did not grasp the idea at first and asked for further enlightenment.

Taking pity on our ignorance he explained his idea at greater length. "As a line is ordinarily built, there are about 40 points of support to the mile at which we usually place insulators. Why spend four to six cents at each of these points in insulating the wire from a dry, seasoned stick of timber, if at from 30 to 100 other places in the mile the wire is resting against the branches or foliage of green, growing, sap-filled trees? Certainly the leakage at each of these places is much more than on a dry seasoned pole."

Had we been a little more alert mentally, we might have known that his first statement had a different meaning than seemed apparent at first sight; that it was framed in rather startling language as a means of driving home its point. For, after all, what is the sense of spending money for insulation at the poles unless insulation between poles is kept up by proper tree trimmings?

Interesting Telephone Financing During September

By R. F. DE VOE & COMPANY, Inc.

A new offering of $3,500,000 par value of the Tri-State Telephone & Telegraph first mortgage 5 per cent gold bonds, series "B" due May 1, 1942, at a price of 98 and accrued interest to yield 5.20 per cent, was promptly oversubscribed by the investing public. The prompt oversale of this issue coming at a time when money is at its highest point in years, stamps the security as being prime and one particularly desired by the large institutional buyers who immediately recognize the investment opportunity. The proceeds of this issue, it is also interesting to note, will be used in part to purchase approximately 80 per cent of the common stock of the Dakota Central Telephone Company. With the inclusion of this property, the Tri-State Telephone & Telegraph Company will embrace a system of over 150,000 stations and a physical plant of a value of upwards of $25,000,000.

The conservativeness of the issue is reflected in the fact that giving effect to this financing the first mortgage bonds of the Tri-State Telephone & Telegraph Company will only be outstanding at 42½ per cent of the value of the physical property without including the additional equity afforded by the Dakota Central Telephone Company common stock being acquired.

A circular describing the issue presents the earnings statement in such an accurate and concise manner that it will be interesting to all telephone men to show it verbatim:

"The earnings statement of the Tri-State Telephone & Telegraph Company for the year ended December 31, 1927, with comparative figures for the years ended December 31, 1925, and December 31, 1926, is as follows:

	1927	1926	1925
Gross income from all sources	$5,607,469	$5,465,114	$5,272,985
Operating expenses, taxes and other expenses	3,189,176	3,161,907	3,030,589
Depreciation reserve	946,348	911,186	878,287
Total revenue deductions	$4,135,524	$4,073,093	$3,908,876
Earnings available for interest	$1,471,945	$1,392,021	$1,364,109
Annual interest requirements on outstanding bonds including this issue	$ 450,000	.....	.....

"The net earnings shown above for the year 1927 were 3¼ times the annual interest requirements on the company's outstanding funded indebtedness, including this issue. For the six months' period ended June 30, 1928, after deducting $489,479 for depreciation reserve, such earnings were $787,316, which is in excess of the 1927 earnings for the same period.

"The above statement does not take into account the earnings which will accrue to The Tri-State Telephone & Telegraph Company through its ownership of approximately 80% of the common stock of the Dakota Central Telephone Company. The net earnings available for common stock dividends for the year ended December 31, 1927, were $250,973. The Dakota Central Telephone Company has paid dividends on its common stock, as outstanding from time to time, at the rate of 6% per annum in every year from 1906 to 1921, and since 1921 at the rate of 8%."

Of particular interest is the way in which depreciation reserve is carried as an operating expense and deducted from gross income to arrive at the amount available for bond interest. It is a method which will find general favor in the entire independent telephone industry.

Another piece of financing also issued in September which may be considered in the nature of telephone financing is the offering of $5,000,000 Utilities Service Company first lien 6% gold bonds, Series "A," due August 1, 1953, which have been offered at 99½ and accrued interest to yield over 6%.

The Utilities Service Company incorporated under the laws of the State of Ohio is acquiring a controlling interest in the Lima Telephone & Telegraph Company and substantially all of the capital stock of twenty telephone companies and four ice companies. It will also acquire substantially all of the capital stock of the Stark Electric Railroad Company, which in turn owns all of the outstanding common stock of the Alliance Power Company. It is interesting to note that the Central Union Telephone Company (controlled by the American Telephone & Telegraph Company) will presumably continue to hold its minority interest of approximately 38% of both the outstanding preferred and common stocks in the Lima Telephone & Telegraph Company.

The properties of the operating companies are all located in the State of Ohio, the telephone companies furnishing service to over 28,000 subscribers and 65 cities and towns including Lima, Ada, Napoleon, Wauseon, Delphos, McConnellsville and Waynesfield. The ice companies operate in the cities of Toledo, Youngstown, Canton and Springfield, Ohio.

The consolidated earnings' statement giving effect to the acquisition of properties and the present financing for the 12 months ended May 31, 1928, is shown below:

Gross earnings	$3,361,206
Operating expenses, including maintenance and taxes other than income taxes but excluding depreciation	2,392,286
Net earnings	968,920
Interest on unpledged bonds of operating companies and minority stock charges	140,354
Net income	828,566
Annual interest requirements: $5,000,000 first lien 6% gold bonds, Series "A" (this issue)	300,000
	$ 528,566

These figures incidentally do not include depreciation as an operating expense and Federal income taxes are also omitted. The consolidated net income as shown without the deduction of depreciation or Federal income taxes is equivalent to 2.75 times the interest requirements on the first lien bonds. The statement does not segregate the value of the telephone property or the ice plants and for that reason it is difficult to formulate

SCHEDULE OF CONVENTIONS

Annual convention United States Independent Telephone Association, Sherman Hotel, Chicago, October 16, 17, 18 and 19, 1928.

Annual convention Independent Pioneer Telephone Association, Hotel Sherman, Chicago, October 18, 1928.

Annual convention Illinois Telephone Association, Hotel Abraham Lincoln, Springfield, November 8 and 9, 1928.

Annual convention Missouri Telephone Association, Hotel President, Kansas City, Mo., ov. 14 and 15th.

what amount might be properly deducted for depreciation. The Lima Telephone & Telegraph Company in 1927 charged over $107,000 to depreciation reserve on its system of over 12,000 stations and if this same depreciation rate per station were applied to the telephone properties alone of the Utilities Service Company there would be a deductible charge of approximately $250,000. If a charge were also made for depreciation of ice properties in a similar amount and this in turn was also deducted from gross earnings, the net earnings available for all charges would total approximately $468,920. As against these earnings which would be further subject to Federal income taxes, the company would have charges aggregating over $635,000, which would include interest on unpledged bonds and minority stock charges, interest on first lien 6% bonds and interest on 6½% debenture bonds.

A third telephone bond offering placed before the public during the month is the $1,800,000 Southwestern States Telephone Company first mortgage 6% gold bond issue, due September 1, 1948, at 99 and interest yielding approximately 6.08%.

This company recently organized in Delaware furnishes telephone service to forty-seven towns and adjacent areas in Arkansas, Oklahoma and Texas. The system comprises 47 exchanges operating 13,628 stations. The company's properties have been recently appraised by engineers at the depreciated value of $3,464,506, which figures approximately $254 per station.

Earnings of the company for the year ending July 31, 1928, giving effect to certain non-recurring charges are shown as follows:

"Gross revenues	$528,297.66
Operating expenses, maintenance and taxes (other than Federal income taxes)	232,839.34
Net income available for interest, depreciation and Federal taxes	295,458.32
Annual interest on first mortgage bonds (this issue)	108,000.00
Balance	$187,458.32

Net income as shown above was 2.72 times the annual interest requirements on the first mortgage bonds outstanding. Of the gross revenue, $218,478.00, or over 41%, were derived from toll business."

In this earning statement, depreciation is not considered in arriving at the number of times the bond interest is earned. If the company were to set up a 5% depreciation on the depreciated value as shown, the net earnings available would be reduced to $122,233.02 available for bond interest and Federal taxes, or 1.1 times bond interest.

The properties of the Southwestern States Telephone Company are contiguous to the properties of the Southwest Telephone Company, both of which have a substantial common ownership.

The advertising of the issue calls attention to the fact that the bonds have beetn authorized by the Arkansas Railroad Commission.

Athens, Ohio, Was Not a Disappointment One Hundred and Fifty Attend Opening

Formal opening of the new exchange of the Athens Home Telephone Company, Athens, Ohio, was the gathering place of telephone men from New York to Chicago on September 19th.

* * *

And Athens lived up to every expectation of the visitors. It is a bustling little city of manufacturing enterprises, the state university, pretty parks, swimming pools, country clubs, and many other worthy institutions.

* * *

But no city, large or small, can boast of a better equipped, more modern telephone exchange than this beauty spot on the Hocking river, seventy-five miles south of Columbus.

* * *

Assembling from all corners of the state of Ohio, as well as surrounding states, telephone men from large and small exchanges gathered to inspect the Athens exchange which was recently completed and now occupied.

* * *

Mayor Alex M. Moore made the address of welcome, adding a number of witty suggestions on how to keep out of trouble, but stated that the hoosgow had been renovated and new linens placed in each private room for the anticipated reception of telephone men.

* * *

J. Warren Safford responded to the address of welcome on behalf of the visitors, and assured the mayor that the telephone fraternity appreciated his hospitality, and assured him that the association would be responsible for the lost linens.

* * *

Luncheon was served in the new building to 150 invited guests of the Athens Home Telephone Company, after which talks were made by a number of visitors. To say that those who attended were surprised and delighted is putting it mildly. They were astonished.

* * *

We are not going to try to describe the many conveniences of this new exchange —that was done in the September issue of TELEPHONE ENGINEER. But the way in which the visitors warmed up to the occasion was a caution.

* * *

Dr. C. L. Jones, general manager of the Athens Home Telephone company, acted as toastmaster. At his left were the directors of his company. On his right were several visitors prominent in the telephone industry. The many nice things said about this company must have caused a blush on the cheeks of the board, but take it from us, every word spoken was sincere.

* * *

After many encomiums were laid at the feet of the manager, board of directors and others who were more or less responsible for the building of this exchange, subjects were covered by some of the speakers pertaining to the telephone business in the matter of publicity. C. H. Harris of the Athens Messenger spoke on the subject of "Public Relations from a Newspaper Standpoint." He told how to get publicity; "be frank with your newspapers," he said. "Tell them the whole story; they know it any way. So be frank with them and they will be frank with you."

* * *

A business program having been arranged for that day by the Southern Ohio Telephone Association, Frank L. McKinney, secretary of the state organization, spoke on the general situation in Ohio, as viewed from his office in Columbus. President Safford of the Ohio State Telephone Association reviewed the work of his organization and the progress made during the past few months.

* * *

If you get tired and weary, and wonder what it is all about; and if the whole telephone business isn't going to the bowwows; if the reward is worth the effort—just take a trip over to Athens and inspect that exchange. Talk to the manager, to the banker, and to the board of directors, and see how easy it is to "put over" a first-class job. They will tell you that honesty, sincerity of purpose, followed by good judgment, proper publicity, taking the public into your confidence, will turn the trick. And we say, Amen.

The first time I read an excellent book it is to me just as if I had gained a new friend; when I read over a book I have perused before, it resembles the meeting with an old one.—Oliver Goldsmith.

Studying Telephone Methods

By E. R. COLLINS

Manitoba Telephone System, Brandon, Manitoba, Canada

CHAPTER 21

Common Battery Signals.

The magneto telephone depended for its battery supply for the transmitter on dry cells. In the previous chapter we studied some of the methods of supplying the transmitter with battery current from a central battery at the telephone exchange. Thus the dry cell has been taken away from the telephone, making it possible to reduce its size and also eliminate some of the equipment required at the subscribers' premises.

The magneto telephone was also supplied with a magneto generator to ring bells of other telephones on the same line, and to signal the operator at the telephone exchange. The common battery supply makes this equipment also unnecessary. The development of the signal systems used in connection with common battery exchanges makes rather an interesting study. In this chapter, therefore, we will discuss some of the features of common battery signals. The ordinary door bell makes a very simple example of a remote controlled signal. It is customary to locate the bell and the battery close together, while the wires connect with the push button any distance away. Closing the push button allows the battery to flow through the bell coils and operate the signal. This is briefly all that takes place when the telephone receiver of a common battery telephone is lifted. The hook switch takes the place of the push button. The signal at the telephone exchange may be a bell, or buzzer, or any other apparatus that will respond to the flow of the battery over the line.

Following the idea a little further we have shown in Fig. 188 the circuit of an ordinary house annunciator system. There are three push buttons, operating each an annunciator coil in the cabinet.

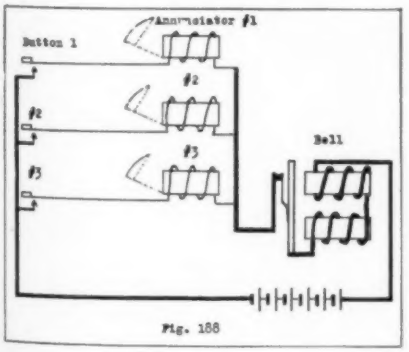

Fig. 188

From the button to each annunciator coil there is a wire that is individual, or for the use of that coil alone. From the other side of the push buttons there is a heavy wire shown, which connects the battery and the bell or buzzer to the other side of the annunciator coils. This wire will be the conductor used when any of the buttons are pressed; in other words, it is common to each button and annunciator coil.

It will be necessary to adjust the bell or buzzer to operate when only one button is pressed. If the current flow with one button pressed is 100 milliamperes, then when two buttons are pressed there will be 100 mils. plus the current passed by the second annunciator coil. The point is that the bell must be made to operate with the current flow of one circuit only. There are some points of comparison between the annunciator system and the operation of the common battery signals.

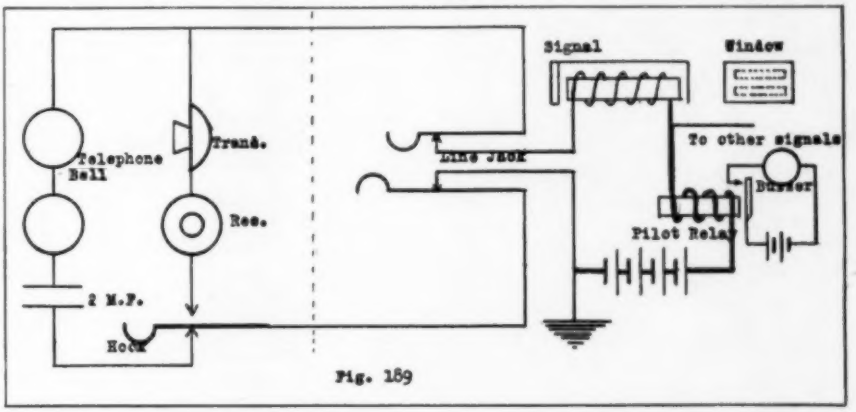

Fig. 189

The Common Battery Telephone

The common battery telephone may consist of a transmitter and a direct current receiver in series for the talking set. When these are connected across the telephone line the battery will flow through them, and any signal device at the exchange would operate.

Referring to Fig. 189, we have shown a common battery telephone of the series type. When the hook switch is down the transmitter and receiver are disconnected from the line. But the bell is then connected across the line in series with a condenser. The condenser will not permit the direct current to flow over the line. The only effect of the battery will be to charge the condenser of the telephone. When ringing current is applied from the exchange it will be reversing in character and will alternately charge and discharge the condenser. The charge and discharge current will pass through the polarized bell and cause it to ring. This arrangement permits two conditions of the line. One where the alternating current is used to ring the bells but prevents the battery from flowing; the other that allows the battery to flow through the signal at the exchange to call the operator.

Types of Exchange Signals

In Fig. 189 the signal consists of an electro magnet with the armature pivoted the same as the magneto drop. The arrow, instead of dropping a shutter or turning a bulls eye, raises a light aluminum target. The target is painted with horizontal white and black stripes. In front of the target is a metal plate with slots as shown in the dotted inset in Fig. 189. The metal plate forms a little window. When the target is down, the black stripes show through the window. As the window is black, a complete black surface is presented before the operator. When battery flows over the line, the target is lifted, presenting white stripes in front of the window. Thus by contrast in colors the operator's attention is called to the line calling.

The battery of common battery exchanges is usually grounded on the positive side. Due to the low resistance of the battery, whether the negative or positive side were connected to one side of a telephone circuit, that circuit would be noisy. Therefore the jack used will differ from the magneto jack. There one side of the line was cut off from the drop coil. In this system both sides must be cut clear from the battery. One side of the line is connected to ground and the other through the line signal to battery. When the operator inserts the plug both sides of the line are cut clear. This is a condition peculiar to all common battery circuits.

Pilot Relay

In Fig. 188 the annunciator coils were all connected in series with a common

bell or buzzer. In Fig. 189 all the line signals are connected in series with one common electro magnet coil. However, instead of the armature breaking a contact as in the bell, it makes a contact which closes the circuit to a bell and battery. The electro magnet in this case does not make any audible or visible signal but causes the bell to do so. The action is relayed to the bell by the use of the electro magnet, with its armature, and make contact. Thus we call this device a relay. Relays are the secret of the operation of common battery systems, whether they be of the manual type or the automatic type.

This relay must be adjusted to operate its contact when only one line signal is operated. The arrangement in Fig. 189 would also mean that the amount of current that would flow through the relay when only one line was calling would depend on the resistance of the line and the telephone in series with the line signal and the pilot relay. Where this type of circuit is used the length of lines must be uniform. Where a battery is grounded we speak of the grounded side as ground battery or positive battery. The other side is called the live side or negative battery. In Fig. 189 it will be observed that the battery is connected in the live or negative side of the battery.

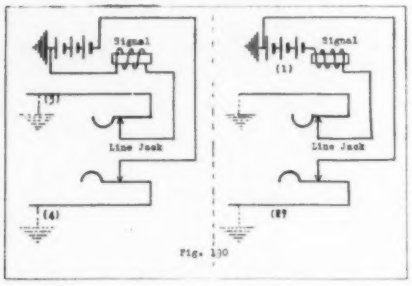

Fig. 190

Referring now to Fig. 190. There are two circuits, one with the signal connected in the ground side of the battery and the other with the signal in the negative side of the battery. Suppose there is a ground at position No. 1, Fig. 190. Then the battery would flow through the signal to ground. If the signal is 500 ohms and the battery 24 volts, then according to ohms law, $C = \frac{E}{R} = \frac{24}{500} = .048$ amperes or 48 milliamperes. There would be no bad effect from this condition, except that the signal would be pulled up permanently.

If there is a ground at position No. 2, Fig. 190, the battery is ground potential and the ground on the line will be about the same, therefore no action would take place. If a ground occurred in position No. 3, Fig. 190, there would be a ground on both sides of the signal coil, and since they would be the same potential, there would be no pull on the coil. But if a ground were on at position No. 4, Fig. 190, there would be fireworks. In all common battery practice it is desirable to arrange all apparatus so that negative battery never appears in keys, or relays or other parts of a circuit where an accidental ground would cause a direct contact with negative battery. Resistance, whether it be lamps or coils, should always where possible be between the battery negative and any points where accidental grounds might occur easily.

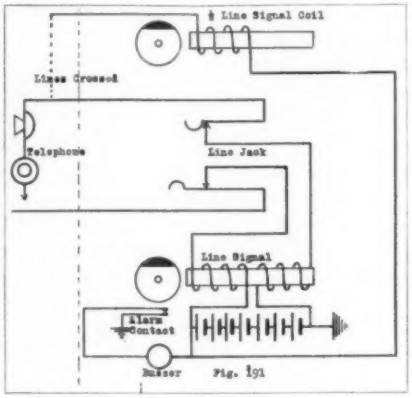

Fig. 191

In Fig. 189 the subscriber would hear a bad noise on the line due to the fact that there was a direct ground on one side of the circuit, while on the other there was a ground through a 500 ohm coil. In Fig. 191 a different arrangement of signal coil is used. Here we have a signal with two equally wound coils on the one core. The coils are so connected that they are both magnetizing the core in the same direction. In connecting up such a coil it will be necessary to have both the coils pulling together, else a weak signal will result. If the coils are wound on opposite ends of the core, the coil that is nearest to the armature or signal will exert the strongest pull. Thus even if both coils are equal and are connected to oppose each other, the coil nearest the armature will exert a stronger pull than the other, and will operate the relay or signal feebly. Unless the installer checks the strength of pull he is apt to pass this condition and the result would be poor service.

The signal used here is somewhat similar to the bulls eye used on magneto boards. But the signal will restore as soon as the current is cut off. Therefore as soon as the operator answers the line the current is cut off and the signal restored.

With this signal a ground on the negative line will cause the signal to operate. A ground on the positive line will not cause any signal. A cross between the positive side of the line and the negative side of another line as shown by the half coil at the top of Fig. 191 would operate both signals and give an indication of trouble. A short circuit on the line of course would operate the signal. The pilot or night alarm circuit here makes use of a local contact on the signal. The contact of the signal is connected to the positive or ground side of the battery, and a 200 ohm buzzer (for 24 volt battery) is connected in the negative or live side of the battery. When the signal shown in Fig. 191 is used, the subscriber would not hear any noise on the line before the operator answered because of the balanced coils connected to the line.

In Fig. 192 we have the same telephone and jack arrangement. One side of the line is grounded and the other side is connected to negative battery through a miniature lamp. These lamps are very suitable for telephone systems, as they can be placed in rows in a very small space.

Now it requires a certain current flow to bring the lamp to its proper brilliancy. The usual resistance through which such a lamp will operate satisfactorily is 100 ohms. This would correspond to about 2,000 feet of 22 gauge cable. The lamp cannot be equipped with any night alarm contact, so the pilot relay is used. This relay must be so adjusted that it will operate with the flow of one lamp over the longest line connected to the switchboard.

If the current flow of the lamp is 100 milliamperes, then the relay must be adjusted to pull up through 100 milliamperes. Now suppose we had 10 lines connected to this board, each with a leak to ground of 100 milliamperes. A flow of 10 mills would not light the lamp. Yet the total flow of the 10 lines would be 100 mills, when the relay will operate the night alarm might ring, but no lamps be burning on the board. This type of circuit would not be satisfactory except for use in factories or offices where the lines will not be subject to the usual line troubles found in city systems.

In Fig. 193 we have the same line arrangement with the one side of the line grounded, but the negative side of the line is provided with a line relay. This relay may be any resistance from 500 ohms to 1,000 ohms. When the receiver is removed from the hook the line relay operates. The contact of this relay closes the circuit of the line lamp. The line lamp circuit is now a local circuit. That is the line lamps of a section of a switchboard all have the same length of circuit to operate over. Therefore if each line lamp operates on 100 mills, the pilot relay will be adjusted to operate on 100 mills at least. If there should be a leak of 10 miles to ground on this line, due to the resistance and the resulting number of ampere turns of the line relay, it would pull up and light its line lamp. Then if there were 10 such lines

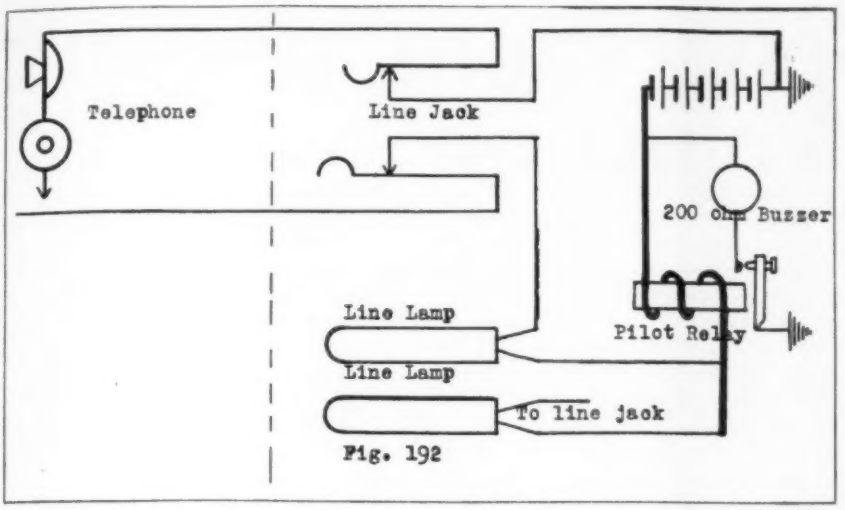

Fig. 192

there would be 10 line relays pulled up and 10 line lamps burning.

The operation of the night alarm circuit with this system can be made dependable, while in the arrangement in Fig. 192 the night alarm might be useless. The 200 ohm buzzer is here connected in the live side of the battery. Two line lamps and relays are shown in this drawing to illustrate the way several line relays are connected to the one pilot relay. This follows out the idea shown in the annunciator system.

If a line relay is operated and it was necessary to change a lamp, inserting the lamp extracting tool often places a short circuit on the lamp. If the relay was pulled up there would then be an excessive flow of battery which would blow fuses and blister the springs of the lamp jack. It is a good stunt to place a toothpick in the relay so that the armature cannot operate when you are working on the lamp jack. The second line relay shown would be connected to its line jack if shown.

In the larger common battery boards the line jacks and multiple jacks are placed very close together. The jacks shown in the previous drawings all consisted of two pairs of contact springs. This type of construction is bulky and very subject to trouble. To overcome the trouble of these jack contacts, a different type of circuit is used. In multiple boards where each line would have several jacks it would be necessary to have several sets of jack contacts to cause trouble due to poor spring tension or dirt in the contacts. The type of jack used consists of the two line springs called the tip and ring, while the opening of the jack consists of a thimble which makes contact with the body of the switchboard plug when inserted. Thus when the plug is in the tip, ring and sleeve contacts would be made.

However, it is still necessary to have the line cut clear of all signal circuits when connected to the cord circuit. In Fig. 194 there is shown the line and cut-off relay assembly. These relays are usually mounted on racks, and only the lamp and jack wires are taken to the switchboard. There would be four wires from each line relay group taken to the switchboard. The tip and ring being the line, wires are twisted pairs. This of course is to prevent any induction from other circuits causing disturbance in the line. The sleeve and line lamp may be in single wires, because there would be no induction bad enough to disturb the operation of these circuits. Battery is supplied through a double wound line relay to the line. In some types of line relays the negative winding is 1,000 ohms, while the positive winding is 100 ohms. This makes an unbalance which would be indicated by the hum in the line before the operator answers. Other line relays have two 1,000 ohm coils which provides a balanced arrangement to the line.

When the battery flows over the line the line relay pulls up and closes the contact to the line lamp. The battery for the lamp is fed through a low resistance pilot relay. This of course is adjusted to operate with the current from any one lamp. Occasionally a line lamp will not operate the pilot relay while another one will. When lamps are almost burned out they will not pass sufficient current to pull up the pilot relay. If the relay pulls up satisfactorily on all lamps but one or two, the line lamp is likely at fault. Better change it.

When the operator puts the plug in the line jack she connects with the line. At the same time battery flows through a lamp in the cord circuit through a resistance of about 100 ohms, over the sleeve of the cord, through the cutoff relay. A 30 ohm relay will pass enough current to light the lamp in the cord circuit and will also pull up with plenty of energy to operate the cutoff springs. These springs cut the line away from the line relay. The signaling is now transferred from the line relay with its lamp to the cord relays and lamps.

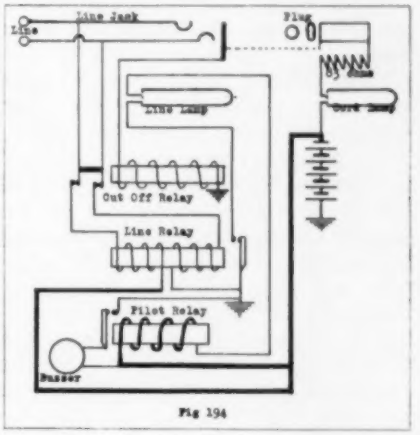

Fig 194

The pilot relay is low in resistance, about 1 ohm. It is necessary to keep the resistance of this relay low, as it must pass sufficient current to light all the line lamps which are fed through it. In Fig. 194 there is shown a buzzer connected to the pilot relay. In actual practice this relay would operate a pilot lamp, which in turn would operate another relay called the night alarm relay. The pilot lamp is usually placed in a conspicuous position.

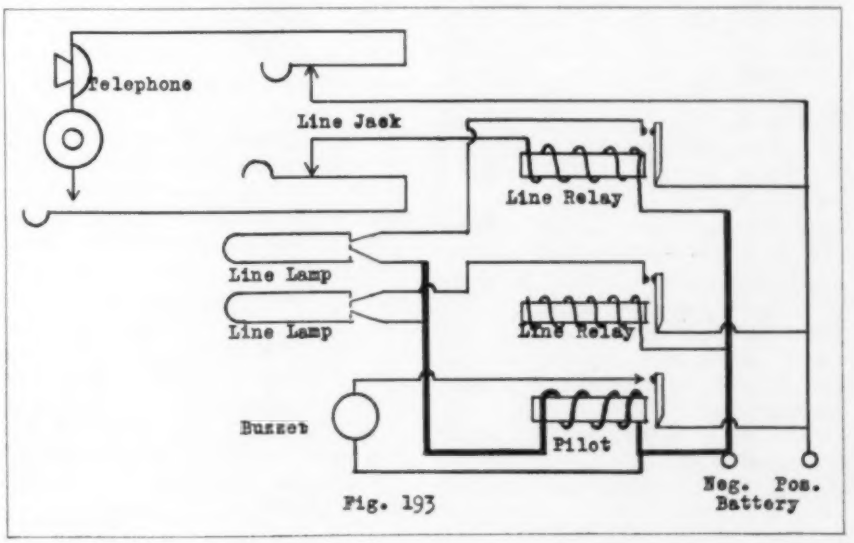

Fig. 193

Practical Suggestions for Plant Valuation

By CHARLES W. McKAY, M. E.*

Before taking up the subject of unit costs, it may be well to round out the discussion of "Cost of Establishing the Business," and also to touch briefly upon the other elements of the non-physical assets, i.e., cost of financing.

General Attitude of Courts and Commissions Relative to Going Value—The following opinion of the California Supreme Court in the Contra Costa Water Co. v. City of Oakland, 113 Pac. 668, typifies the general attitude of courts and commissions on the subject of going value:

"Both of these witnesses also included in their totals an item of $500,000 as the value of the going business of plaintiff. Their theory in regard to this item was, as stated by learned counsel for plaintiff, that the property and business of the plaintiff had a value as being the property and business of a concern which, in the legal and commercial sense, is a 'going concern,' and which has a thoroughly established business over and above and in addition to the mere cost or costs of reproduction of its property and plant, and what the value of said property would be at the time when its works were just completed. . . .

"It may be conceded that the fact that the works of plaintiff are in actual use as part of a going concern gives them a greater value to the stockholders than they would otherwise have. It supplies the capacity to earn returns which would otherwise be wanting.

"Purely for the purpose of this decision we may assume it to be true as was said by Judge Farrington in Spring Valley Water Co. v City and County of San Francisco, supra, that the value of the going business and franchise depends upon their earning power. Where, as here, that earning power depends on the rates to be fixed annually by the city council in such a way as to give only a fair return on the property in use, and the franchise is neither exclusive nor defined by any special contract with the city, these elements would appear to play a very small part, if any, in the matter of valuation. However this may be, it is plain that none of the witnesses furnished any evidence upon which any value could be added on account of either of these items.

"The theory of both Mr. Adams and Mr. Schuyler was, as stated by plaintiff's counsel, that this value was measured by the losses sustained and the deficiencies of income accruing to it, in the early period of its operations, and up to the time that it had been brought to a paying basis. Mr. Kiersted, the only other witness on this subject, measured the value of this element of 'going concern' in practically the same way. Mr. Adams in one of his estimates concluded, as a matter of individual judgment, that in an enterprise having the characteristics and magnitude of the old Contra Costa Water Company, there must have been in the inception of the concern losses or deficiencies in income to the extent of $500,000.

"In his other estimate he made a computation of the early losses, treating them as the differences between the return of 5.63 per cent, which the company had actually received, as computed by him from its annual statements, and the return of 7 per cent, which he believed it should have received. Mr. Schuyler and Mr. Kiersted followed the same general lines. This was all the evidence supporting this item. We think it very clear that it had no relation to the question of present value, and afforded no basis for any valuation by the trial court of either of these elements—franchise or going concern. . . .

"It is unnecessary to say that the burden was on the plaintiff to furnish data showing that these elements had a distinct, independent productive value, before any such value could be included. See, in regard to value of franchise, Willcox v. Consolidated Gas Co., supra.

"In what we have said we do not desire to be understood as deciding that in the matter of fixing water rates, anything at all should be added to the value on acount of the element of 'going concern.'"

It will be noted that the court, while admitting the existence of going concern value, holds that the plaintiff has not been able to furnish sufficiently conclusive evidence to warrant the inclusion of this item in a rate-base appraisal.

This opinion clearly shows the need for clear-cut, readily assimilated methods of determining going value. The more complex methods, whatever their value from an engineering and accounting standpoint, only tend to befog the issue, and have very little chance of securing the favorable consideration of either courts or public utility commissions.

Cost of Financing—In financing utility properties it is usually necessary to offer some inducement to obtain capital over and above the interest paid on the borrowed moneys. The reason for this will be obvious. People are not prone to hazard their money in a new undertaking unless the opportunity for gain is more alluring than in other firmly established and equally remunerative (so far as the fixed rate of interest is concerned) fields.

This cost financing, or cost of enticing capital, as it might well be called, may be divided into two general classifications —cost of securing preliminary capital and cost of securing permanent capital.

At the beginning of the construction period there is, of course, no tangible property to mortgage. The backers of an enterprise must be men of sufficient credit to borrow on short-term notes enough money to start the enterprise.

To obtain such capital it is necessary to pay high rates of interest. In one of the western states it is customary to pay 6 per cent for capital secured on first mortgage bonds and nearly 7 per cent for moneys borrowed on short-term notes. The difference between these two rates —1 per cent—is an element of the cost of financing.

Toward the end of the construction period, when the utility corporation has been brought into being and endowed with a tangible and marketable property, these short-term notes are retired by the sale of permanent securities, but even at this time it is necessary to offer an inducement to secure capital.

In the first place, to insure the speedy disposal of permanent securities, it is necessary to call upon a reputable firm of financial agents—a banking or brokerage house. This involves expense for investigations on the part of the fiscal agents, for no firm will assume the responsibility of financing a property until it is thoroughly satisfied as to the soundness of the enterprise.

Next comes the expense of marketing the securities, and the profit to the financial agents, and, lastly, some inducement in the way of an under par price must be offered to attract the investing public. As a result, securities having a redeemable or par value of $100 per share often do not net the utility more than $90.

It will be seen that the cost of financing is a very real element in the total cost of producing a utility property, and

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one that is certainly entitled to consideration in ascertaining the reproduction cost.

The attitude of courts and commissions on the subject of financing cost is evidenced by the following quotation:

"The plant in question here, for instance, was built by borrowed money or by the sale of securities which not only bear interest at 6 per cent from the time they were issued, but which also had to be discounted at no less than 8 per cent besides. In other words, they brought 8 per cent less than par value in the money markets.

"If the plant was needed and these were the best terms upon which the capital for its construction could be obtained, it is certainly difficult to see what other disposition can be made of these charges than to include them in the cost of the plant, at least until they can be written off from earnings, if this course should be found to be advisable, for it is clear that no private party would enter a business of this kind if they had to foot such losses out of their own pockets.

"Such interests and discounts, therefore, often constitute a part of the price upon which the consumers must pay interest if they desire the conveniences that are offered by the utilities, because these are usually the best terms upon which such utilities can be had. These facts indicate quite clearly that the amount of interest or discount that it may become necessary to include in the construction account is a question that depends upon the facts in each particular case, and that it is a matter that cannot always be determined in advance."

Cost of Financing During the Construction Period—In the following illustration of the method of computing the cost of financing, taken from a recent appraisal, the cost of financing during the construction period is first considered.

Under cost of financing has been included the extra cost of raising money during the construction period over and above the ordinary investment interest, and also the cost of the permanent financing of the enterprise after it has become an operating concern.

The plan of financing adopted for the purpose of this appraisal has been that the moneys required during the construction period would be raised by short-term notes, which would be retired, as the various portions of the plant were put into service, by the selling of permanent securities in the form of stock and bonds.

Interest during construction has been figured at the rate of 6 per cent, and has been included under that caption. It seems certain, however, that the rate of 6 per cent is not sufficient to provide funds during the construction period for the establishment of a new enterprise. A study of the notes authorized by the California Railroad Commission on light, power, gas, water and telephone companies as far back as 1913 and 1914 shows that the average rate of interest on notes was 6.992 per cent, or practically 7 per cent.

Since stock or bonds could not be sold during the construction period, except at an enormous sacrifice, it has been assumed that the parties building the plant were men with sufficient credit to borrow, by short-term notes, on a new enterprise at practically the same rate as the average rate paid in this state on more or less seasoned enterprises.

This computation is shown in Fig. 5.

	FIRST YEAR		SECOND YEAR	
	1st Half	2nd Half	1st Half	2nd Half
Basis for calculating cost of financing during construction (obtained from the construction schedule, Fig. ..)	$120,241	$678,969	$ 735,460	$1,003,862
Interest at 3.5 per cent	4,208	23,764	25,741	35,135
Total for period	$124,449	$702,733	$ 761,201	$1,038,997
Interest on previous notes at 3.5 pct	.....	4,355	29,104	56,764
Face value of notes	$124,449	$707,088	$ 790,305	$1,095,761
Total notes issued	$124,449	$831,537	$1,621,842	$2,717,603
Value of plant covered by permanent securities issued at end of period	.....	.....	.....	.....
Total notes outstanding at end of period	$124,449,	$831,537	$1,621,842	$2,717,603
Construction in process at end of period, including interest during construction	122,045	814,860	1,585,798	2,652,292
Cost of financing during construction period	$ 2,404	$ 16,677	$ 36,044	$ 63,311

Fig. 5—Computation of costs of financing during construction

THIRD YEAR		FOURTH YEAR		FIFTH YEAR	
1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half
$1,127,260	$1,040,969	$1,073,994	$ 844,264	$ 626,815	$ 658,802
39,454	36,644	37,590	29,549	21,939	23,058
$1,166,714	$1,083,613	$1,111,584	$ 873,813	$ 648,754	$ 681,860
$ 95,116	$ 139,280	$ 12,894	$ 11,320	$ 9,385	$ 6,702
$1,261,830	$1,222,893	$1,124,478	$ 885,133	$ 658,139	$ 688,562
$3,979,433	$5,202,326	$6,326,804	$7,211,937	$7,870,076	$8,558,638
.....	4,833,912	6,003,376	6,943,782	7,678,586	8,367,750
$3,979,433	$ 468,414	$ 323,428	$ 268,155	$ 191,490	$ 190,888
3,876,030	221,072	158,611	91,148	7,413	.....
$ 103,403	$ 147,342	$ 164,817	$ 177,007	$ 184,077	$ 190,888

The Computation of the Permanent Financing—The plan of permanent financing contemplates the issuance of permanent securities as an evidence of the total investment in the property. Whether these securities would be in stock, in bonds, or partly in each, is immaterial.

A study of the bonds authorized by the railroad commission of this state, covering light, power, gas, water and telephone properties during 1913 and 1914, shows that the 5 per cent bonds, aggregating $21,468,000, were sold to net 88.25 per cent of their par value, and that the 6 per cent bonds, aggregating $8,359,200, were sold to net 91.25 of their par value. Based on this showing, we have assumed that the securities covering this property could be sold to net 90 per cent of their par value.

The cost of permanent financing will be as follows:

Total value of plant, consisting of all items down to and including construction in process (Fig. —)	$ 8,592,475
Cost of establishing the business	2,292,954
Working capital	221,513
Cost of financing during construction	190,888
Total amount to be financed at 9 per cent of par value	$11,297,830
Discount, or cost of permanent financing	1,255,314
Total securities issued	$12,553,144
Cost of permanent financing	1,255,314

This means that, in order to raise the total amount invested in the property at the time of its permanent financing, $11,297,830, it would be necessary to issue $12,553,144 worth of securities, representing a cost of permanent financing of $1,255,314.

The Total Cost of Financing—The total cost of financing, therefore, will be made up of:

Cost of financing during construction	$ 190,888
Cost of permanent financing	1,255,314
Total cost of financing	$1,446,202

In a very general way all of the elements component to the total reproduction cost of a telephone property have been discussed. Many of the illustrations of methods of computing the items of collateral cost and the tangible values have been taken from actual appraisals. Rather than complicate the text by an attempt to outline all of the possible methods which might be, or have been, used, the writer has, in each case, selected for consideration what seemed to him the clearest and most plausible method, and the one which has had the most favorable consideration at the hands of courts and commissions.

Television Is Coming, But Not Very Soon, Say Experts

Washington, D. C.—With increased activities in the television field, government radio experts, and especially members of the federal radio commission, have evidenced the greatest interest in the subject.

"Television is of course in the experimental stage," said W. D. Terrell, chief of the radio division of the Department of Commerce, and one of the first radio men in the government service.

"If you refer to the opportunity one has to see a picture of the party talking at the transmitting station, I cannot see that this presents anything of great interest to the public, but if you refer to the opportunity to receive by radio a reproduction of action such as the speaker, including the surrounding crowd, sporting events, fires, automobile or train wrecks, and things of that kind, I believe that this possesses great interest to the public, perhaps not secondary to our present day radio sound transmission.

"I am hopeful that this form of television will be available to the public within a few years and that those who administer the radio law will make provision for satisfactory reception for the public by providing adequate space in the ether."

Judge Ira E. Robinson, chairman of the radio commission, along with the other members of the commission, has witnessed television experiments, and he also has heard much about it during the course of the commission's work.

"Plainly television has not yet reached the stage of public utility," said Judge Robinson, discussing the problem.

"Other than for experimental purposes, the broadcasting band cannot be spared to it without detriment to the public. This is the testimony of the leading radio engineers of the country."

Television is today science's most fascinating experiment, according to Commissioner O. H. Caldwell. The "point to point" method now used seems to put definite limitations on future development, he added, however.

Commissioner Sam Pickard of Kansas says that "after witnessing several television demonstrations I am inclined to believe that nothing can forestall the practical application of this marvelous invention within the next few years."

Harold A. La Fount, radio commissioner from Utah, is another member of the commission who has expressed much interest in television.

"Successful experiments and demonstrations," he said, "proved conclusively the feasibility of the methods in use at this time. However, perfection is not yet in sight. In my opinion, it will require a few more years of hard work, study and experimenting before the goal will be reached, and before it will have any material value.

"In fact, I am not yet ready to say that in its perfected state it will have much, if any, commercial value. The public alone can determine this."

Louis G. Coldwell, general counsel of the commission, however, warns the public not to be too optimistic about television.

"From what radio engineers have told me," said Mr. Caldwell, "I believe that the public should not be too optimistic in their expectation of practical results in television, at least in the immediate future. In the present state of the art, I am told, there are serious limitations standing in the way of the communication of a clear and realistic reproduction of spectacles corresponding to moving pictures. Nevertheless, we may all have confidence that American industry and ingenuity will do all that is humanly possible to make this new development in the use of the ether available to the public."

Texas Holding Good District Meetings

The Texas Independent Telephone Association held another good meeting at Corpus Christi during September. Although this city is on the south coast of Texas, and some of the Texans were compelled to ride 500 miles to be present, near one hundred were in attendance.

Texas seems very much alive to the need of district meetings, as every one so far has been well attended. Interesting subjects covering the different phases of the industry were discussed. A district meeting will be held at San Angelo, November 21st and 22nd.

The San Angelo Telephone Company is just opening up a new exchange, which is one of the most modern in the state. When completed it will be automatic throughout.

Control of Dakota Central Telephone Company to Tri-State Announced

Acquisition of controlling interest in the Dakota Central Telephone Company, Aberdeen, S. D., through purchase of more than 60 per cent of the common stock, was announced late in August by C. W. Robinson, president and general manager of the Tri-State Telephone & Telegraph Company, St. Paul, Minn. Stockholders received $200 per share.

No definite plans have been made relative to just how the property will be handled, Mr. Robinson said. "It is quite probable," he stated, "that for the present at least the Dakota Central will continue to operate as a separate organization and that the position of the Tri-State company will be simply that of a majority stockholder of the common stock."

The Dakota Central company operates 38,000 telephones, nearly one-half of which are of the dial type, and owns approximately 4,000 miles of toll pole lines. The assets of the corporation today are close to six million dollars. The company was founded in 1886 by the late J. L. W. Zietlow at which time he established an exchange in Amerdeen, S. D., with about 60 stations. The same year a toll line was placed in service between Aberdeen and Groton and Aberdeen and Columbia, both towns only about 20 miles distant from the home office. Until 1896 the company experienced very little growth. At that time many additional subscribers were added to the system and toll lines were built between Aberdeen and Redfield. In the following year the toll line to Groton was extended to Ortonville, Minn. Through extension of lines and purchase of other existing telephone properties the company grew to considerable size in the years from 1896 to 1904. In that year the present corporation was organized and in the intervening years expansion has been steady and consistent.

Disturbing Factors on Repeatered Lines

By F. J. DOMMERQUE
Fellow A. I. E. E.

Introductory Remarks

In the September number of the TELEPHONE ENGINEER a general discussion of repeatered lines was given. Such lines are used exclusively for toll and long distance service and are gaining daily more in importance as they are also of eminent service in the development of fast express; that is, two-number toll service in areas surrounding our large cities, where telephone traffic is assuming such proportions that it pays to use cables for the entire toll plant in such areas. As the toll and long distance system in this country is owned and operated by the American Telephone & Telegraph Co. and as such a vast system must be constructed and maintained in the very best manner to give such service as is compatible with, and subservient to, modern business methods, regular and comprehensive texts and observations must be made to check the proper working of the system physically and with regard to efficiency, but also to find the right direction in which to proceed when making extensions and to lay the foundation for a study of improvements conditioned by the progress in the art.

The engineers in charge of this work have collected data valuable for record and research; have systematized same and published from time to time the results of their observations. The occasional publications in the transactions of the American Institute of Electrical Engineers by Gherardi, Jewett, Osborne, Clark, Mathes and others are the best available source of information on the subject and are made use of in the discussion and papers to follow, wherever it can be done to advantage.

Referring to the September number of the TELEPHONE ENGINEER, the statement will be found that in the transcontinental New York-San Francisco telephone line the energy or power delivered at the end of the line was seven times as large after the line was improved, and after the loading coils in the open wire part were removed as at the time when the first repeaters were installed in the loaded open wire line. This statement will now be illustrated by the diagrams in Fig. 1. These diagrams show the power levels, that is, they indicate the amount of power or energy in microwatts available at each point of the line. In an earlier paper we stated that the amount of power delivered to the line at the transmitting end amounted up to 2,000 microwatts and that the power to be available at the receiving end to reproduce the speech should be at least 2 microwatts. In the diagram, Fig. 1, the power delivered to the circuit at the San Francisco end was assumed as 1,000 microwatts; it was found that the power delivered to the local circuits at New York was 10 microwatts in the case where the entire line was loaded and contained six intermediate repeaters, while in the case where the loading coils were removed from the open wire circuit and the number of intermediate repeaters was doubled, 70 microwatts were obtainable at the New York end. It may be noted that the diagrams in Fig. 1 are drawn on logarithmic paper with the scale of ordinates divided on the logarithmic basis leaving the scale of abscissae on the regular basis. This is done for the sake of convenience, as with the ordinates also on the regular scale the diagrams would become unwieldy.

In the aforementioned paper, furthermore, a supplementary attenuation net-

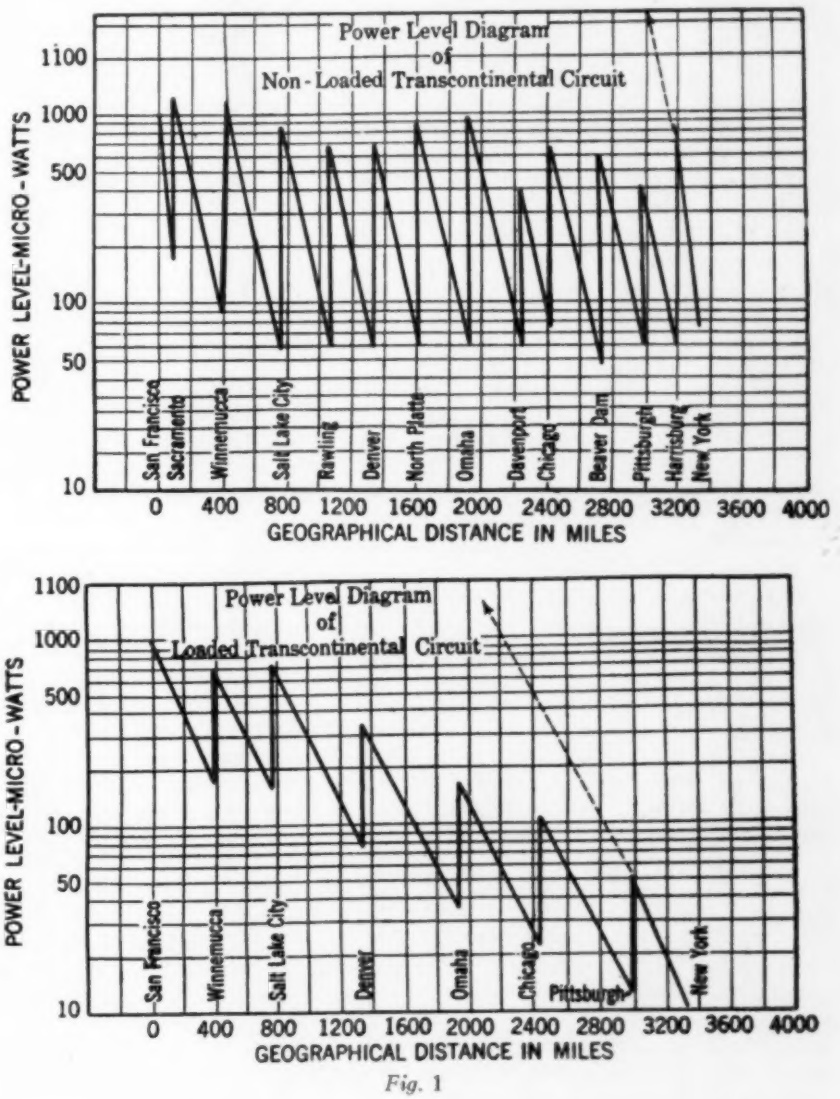

Fig. 1

work was suggested as a means of equalization of the attenuation of the speech frequencies for the purpose of avoiding distortion. Other methods to obtain the same end in view are by compensating the reactance of the input transformer by condensers and induction coils.

It also had been stated that the 21-type repeater was not well adapted for

long lines containing more than one repeater on account of the difficulty of obtaining exact symmetry in the impedances on both sides of the repeater; a difference in impedance would unbalance the currents flowing in the repeater, thereby causing continuous oscillations which would show themselves as "singing." The 22-type is preferable on long lines with a number of repeaters, as the balancing networks effect a balance much easier. A four-wire repeater circuit is best adapted for very long lines, not requiring any balancing networks in the four-wire part of the circuit and consequently avoiding the danger of distortion better than the other circuit types.

"Echo" effects had also been mentioned before; these will be discussed presently. To facilitate the discussion a few data pertaining to loading will be repeated from previous papers. Although the present rule is to load in repeatered circuits only the cables, this does not mean that these cables are all underground; in fact, the toll and long distance system of the future will in all probability contain aerial cable on the majority of lines. The cables in repeatered lines are nearly all either No. 19 B. & S. gage or No. 16 B. & S. gage. For four-wire circuits

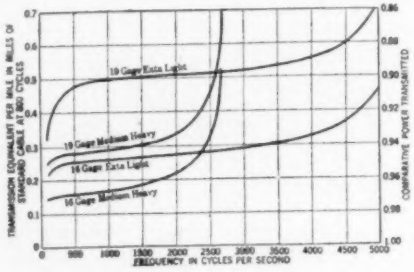
19 Gage Extra Light
19 Gage Medium Heavy
16 Gage Extra Light
16 Gage Medium Heavy
FREQUENCY IN CYCLES PER SECOND
COMPARATIVE POWER TRANSMITTED

Fig. 2—Attenuation-frequency characteristics of loaded cable side circuits

the No. 19 gage cable is used nearly exclusively.

There are two methods of loading these cables, medium heavy loading and extra light loading. The loading coils intended for medium heavy loading have an inductance of 0.175 henry in the physicals (phantoming the lines is presupposed), with a coil spacing of 6,000 feet. The capacity of a loaded section between coils is approximately 0.074 microfarad for the physicals. The characteristic impedance for the medium heavy loaded physical circuits has been set at about 1,600 ohms with a cut-off frequency of about 2,800 periods per second. The inductance for the extra light loading coils amounts to about 0.044 henry for the physicals with a coil distance of 6,000 feet. The characteristic impedance of the extra light loaded physical circuits has been chosen at about 800 ohms and the cut-off frequency at 5,600 periods per second.

In Fig. 2 the attenuation-frequency characteristics of the two types of physical circuits for both kinds of loading are given. The curves show how the larger coil inductance for medium heavy loading reduces the attenuation for frequencies below 2,500 periods per second, while frequencies in the speech range present a uniform or rather constant attenuation by extra light loading; hence extra light loading is most suitable for long lines. In addition the extra light loaded lines possess a higher transmission velocity, which may be calculated by means of the formula $V = \frac{1}{\sqrt{LC}}$, wherein V is the velocity per second, L the inductance in henry, and C the capacity in farad, all for the same unit of length.

The inductance of the medium henry loaded circuits being four times the inductance of the extra light loaded circuits, the propagation velocity in the extra light loaded circuits becomes twice as great, which circumstance increases considerably the repeater efficiency.

A third circumstance favoring the extra light loading consists in the avoidance of perceptible "transients," of which we will speak some other time. Consequently the preference of extra light loading for long lines is justified, while medium heavy loading of cables is restricted to short lines, where the just mentioned reactions are inconsiderable and besides, where the lesser attenuation permits of a corresponding decrease in the number of repeaters. To the Figure 2 the following useful information may be added, pertaining to the various methods of expressing the attenuation. As is well known the original transmission unit in the United States has been the "Standard Mile," which represented one mile of No. 19 B. & S. G. cable of the kind that was in use in the earliest days of telephone cable construction. This standard mile was later supplemented by the "800 cycle mile," better suited to scientific methods of measuring. The standard cable mile has an attenuation constant = 0.122, and the 800 cycle mile has an attenuation constant = 0.019. In late years the need of a still more scientific unit was felt and a new transmission unit was adopted, the TU, which is slightly different from the two units mentioned above. Its attenuation is 0.115; hence to convert standard miles to TU, one multiplies the standard miles by $\frac{0.122}{0.115}$ or 1.06. To convert 800 cycle miles to TU, the multiplication factor is $\frac{0.109}{0.115} = 0.95$. Of course, all above attenuation statements are per mile. If it is desired to obtain the attenuation constant in βl per kilometer, the attenuation per mile has to be multiplied by 0.62; thus 1 TU (which means one TU per mile) = 0.0715 βl per km.

Echo

The effects of reflections of the electromagnetic waves at points where the line construction changes or some kind of apparatus is connected to the line, will not cause any perceptible disturbance on ordinary lines as the modern methods of line construction and of cable manufacture have obtained such a high degree of perfection, that these reflections do not need to be taken into consideration. It is, however, a different thing when repeaters come into play, particularly on account of the difficulties experienced in balancing lines by balancing networks.

The repeaters not only sustain the talking currents, but also the reflections; if in addition the line is long enough to give noticeable duration to the transmission time and if at the same time the transmission losses are small enough to preserve some of the reflected energy, the listener will receive an impression which may be compared to an "echo." This echo effect on long distance lines corresponds to the singing caused on shorter lines by faulty or insufficient balancing; this teaches us that the gain to be obtained on long lines by means of repeaters must be limited to an amount well below the gain at which singing, near singing or distortion takes place.

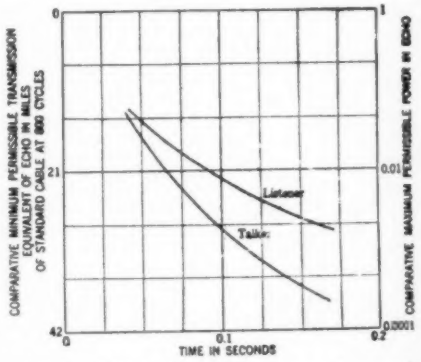

Fig. 3—Effect of echoes on talker and listener

When in a four-wire circuit repeater the speech current passing over the one pair of wires reaches the receiving end, a part of it will flow to the receiver. But the balance between line and balancing network not being quite perfect, a part will flow back to the originating end over the other pair of wires and become noticeable in the receiver of the talker, presupposing the circuit is long enough to cause a perceptable timelag. We may designate this as the first echo. At its arrival at the sending end, it will be split here also, one part will pass to the receiving end over the first two wires and appear as an echo in the receiver of the listener. Again a part of the echo will leave the receiving end as a second echo

and so on. It depends on the cause of its origin how many echo effects are produced. In a trial over an artificial line 1,000 miles long, in which the balances at both end stations were made poor purposely, twelve echos followed each other before the echo died out entirely.

The transmission velocity of an extra light loaded circuit is about 20,000 miles per second and of a medium heavy loaded circuit only half as great. With other words, the speech requires 0.05 seconds to travel over an extra light loaded circuit one thousand miles long. Thus an echo going and returning over this same circuit would arrive 0.1 seconds after the impulse which created the echo. As the time required for a medium heavy loaded circuit is twice as long, the timelag in extra light loaded circuits is less inclined to cause echo effects. To obtain good speech transmission it becomes essential to keep the echo effect at a low level. If it is possible to render the first echo small in comparison with the direct speech transmission, the subsequent echos will lose their force entirely.

The echo effect in a 22-type repeater circuit is considerably stronger than in a four-wire repeater circuit, because the unbalances at the intermediate repeaters have to be taken into consideration and besides the reflections at adjacent repeaters due to the difference between repeater impedance and line impedance. Hence the restriction in the application of 22-type repeaters to shorter distances, where the echo effect has not so much chance to build up.

The transmission velocity should be made as great as possible, in 22-type repeater circuits as well as in four-wire repeater circuits. In Fig. 3 it may be seen how the echo effects vary with the length of time they are delayed. The upper curve marked "Listener" indicates the effect upon the listening party and the lower curve marked "Talker" the effect exerted upon the talking party. From the curves it can be learned how strong the echo may be proportionately for the different time lags to avoid a noticeable disturbance of the conversation. The upper curve relates to the power or energy received direct by the listener and the lower curve to the power delivered directly by the talker to the circuit. In both curves the ordinates give the comparative minimum permissible transmission equivalent of echo in miles of "800 cycle" cable miles.

Echo Suppressors

Naturally as echos are such an unpleasant feature in long distance circuits, the desire grew up to avoid them entirely. A comparatively simple method was soon developed to prevent echos on four-wire repeater circuits, but for two-wire circuits to our knowledge no devise has been designed so far; no doubt in time to come echo suppressors for two-wire circuits will also appear.

The principle underlying echo suppressors in four-wire repeater circuits is rather simple; it consists in permitting or rather making some of the current flowing in the talking circuit to take its path over a bridge across the two sides of the four-wire circuit and amplifying it so that it is able to operate a relay, which short circuits the return path of the echo in the side of the four-wire circuit opposite to the one to which the bridge is attached to let the talking current part enter. This principle is illustrated in its simplest form in Fig. 4. S is the talker station, L the listener station, N is a balancing network, R is a repeater, A is the amplifier and B the cut-off relay in the bridge. It will not be necessary to give the details of the operating circuit; if we draw out and describe the circuit of one-half of the suppressor, that is, the circuit of the bridge in one direction, it will explain also the process in the other direction, as both halves operate the same.

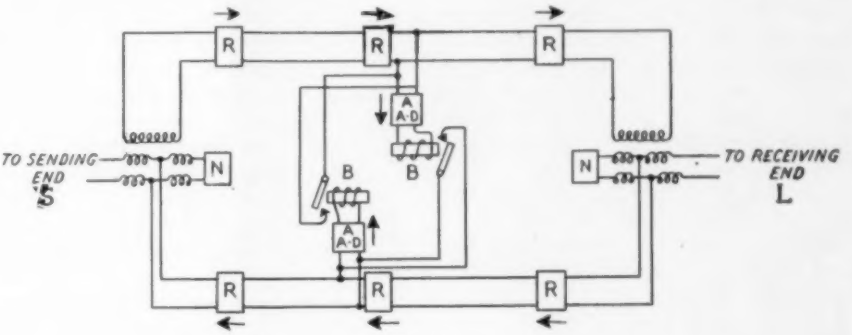

Fig. 4

In Fig. 5 the speech currents coming from the talker station over the upper side of the four-wire circuit pass first to a transformer over condensers which serve to render the circuit efficient at the more important voice frequencies, but less efficient or practically inefficient at other frequencies. This is principally done to cut out as much as possible of the relay noise. The circuit is given a high impedance. The secondary winding of their input transformer is subdivided so that it can be tapped at various points if any change is desired in the sensitiveness of the device.

Of the two vacuum tubes the first one (A) is an amplifier pure and simple, while the second one (A-D) acts at the same time as a detector. The grid potential of the second tube is made large enough to reduce its space current to zero when no input is applied to the circuit, but when the speech currents flow, they will produce fluctuations, the positive effects of which upon the grid are utilized for operation of the COR relay. The operation of this relay in the first instance grounds the one winding of the auxiliary relay CR and in the second instance causes the slow release relay SR to operate; the relay CR then cuts off the other; that is, the lower side of the four-wire circuit. The relay SR is made slow releasing by placing in series with its one winding an adjustable low resistance, the adjustment being set normally for a releasing time of 0.1 second. As a consequence the release of relay CR is retarded to keep it under control of relay SR in case no more speech current flows to actuate the suppressor and when relay COR is de-energized. The condenser in the circuit between detector tube plate and filament serves to average the half

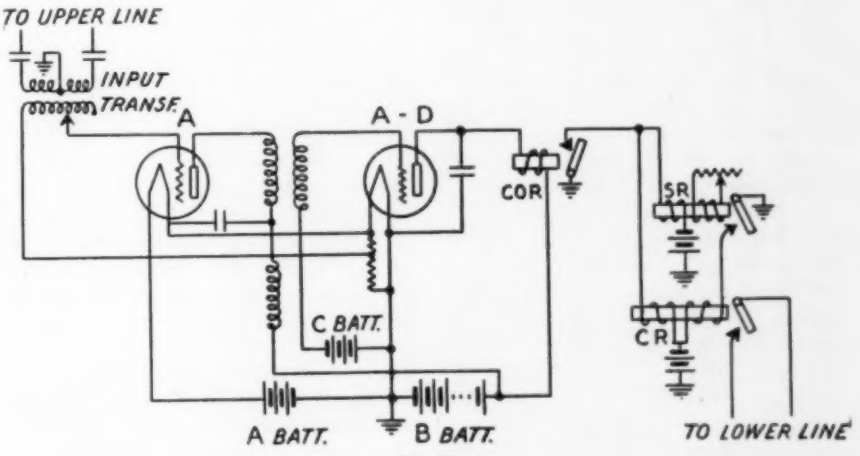

Fig. 5

waves of the applied speech current after rectification to secure smooth and positive operation of relay COR.

Crosstalk

The maximum value of the energy at the repeater stations is fixed in the first instance by the capacity of the vacuum tubes; in the second instance by the capacity of the talking circuit loaded so as to be free from disturbing distortion; and third by the necessity to avoid crosstalk into other circuits. On the other hand the energy must not fall below a certain amount, otherwise it may not suffice to withstand the influence of crosstalk from other circuits. Care must be taken to keep the energy amounts in neighboring parallel telegraph and power circuits in such limits as will prevent same from causing disturbing noises in the telephone circuit, as far as this is possible.

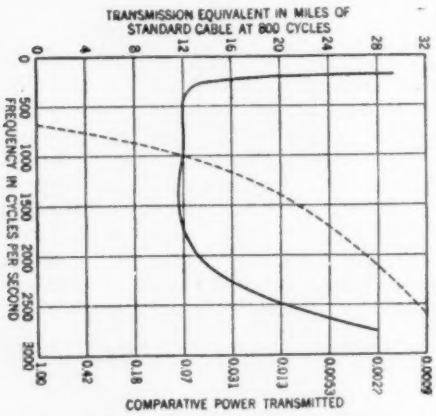

Fig. 6—Transmission-frequency characteristic of long extra light loaded four-wire circuit

While in some four-wire circuits a maximum of energy is transmitted in one direction, a minimum of energy may be transmitted in the opposite direction, which may cause crosstalk from one four-wire circuit into the others. To avoid this the circuits in the cables transmitting a large quantity of energy should be protected statically from the circuits carrying small amounts, which can be accomplished by bunching all conductors transmitting in one direction and also those transmitting in the opposite direction, and separating the two bunches. The separation should also be made in the loading coil pots. At the repeater stations the apparatus and conductors connected to the inputs of the repeaters should be kept separated from those connected to the outputs.

On long lines containing a number of repeaters, the latter and their accessories should be so designed that the amplification gains take different; that is, corresponding values with different frequencies in order to render the over-all transmission constant at the different frequencies, notwithstanding the losses caused by the cable circuits not being constant.

The full drawn curve in Fig. 6 obtained by experiments with four-wire extra light loaded circuits 1,080 miles long, demonstrates what can be done with a repeater and its accessories designed for equalization of transmission. The dotted curve indicates what would have resulted if the repeaters had worked with the same gain at all frequencies.

"My Blow Torch, My Best Friend"

By H. B. GASH

Mgr. Avon Tel. Co., Avon, Ill.

When I started in telephone work 30 years ago I had many weird experiences holding a job. I was working on small plants mostly and could not make good in several cases, for the owners seemed to think that all one had to do was to go out and work without material. At that time I was very light in weight and could not do heavy work, so took up trouble work when I could. I soon learned that in the smaller plants, a great many cases of trouble were due to high resistance joints, but all I had been taught was to scrape the wires and put them back together. The trouble was cleared for the time being but it would not be long until I would have to do the same thing over again. All the time the owners would keep saying that if they had a soldering iron we would solder the joints. Finally I bought myself a soldering outfit to see if I could learn to solder. For a while it did not work with satisfaction, so one day I went to a tin shop and had a talk with the tinner and I soon learned that my trouble in part was due to my not cleaning the parts to be soldered. After cleaning the wire and having my iron well tinned soldering was quite easy. I got quite interested and pulled slack and soldered joints until I lost that job, for every time I soldered a joint there was less chance for trouble. By keeping up on my soldering I finally put the plant in such shape that my services were not needed, but I was convinced that soldering was a very important and needed factor in giving good telephone service.

When work was scarce I took my outfit and started out looking for this kind of work as a specialty, soldering the jumper taps on the pole end of the house drop and then at the house and was paid more than the average lineman. After knocking around the country for about 17 years through every state west of the Mississippi River except Louisiana I met an operator and we were married and both took work with the same company. After three years we had a chance to buy a small plant which consisted of about 200 telephones, a streak of rust and a franchise. It was not much but it was the opportunity that I had long wanted, so we made a down payment and went to work. We did all our own work for three years. I started in on this plant resetting poles, building corners, cutting brush and pulling slack and soldering the joints. All iron joints of the Western Union type were bridged with a piece of copper that I had secured from old bridle wire or house wire. I brightened the rusty iron wire about one inch from each end of the splice, cleansed the copper, used a little paste and applied the torch.

In using the torch to heat the joint one should work fast and not allow too much heat to be applied or he will burn the wire. The results were surprising. When I finished my soldering, people living out on the rural lines 5 or 6 miles that you could just hear in a whisper came through with good volume and when I asked for an increase in rates the community helped me get it.

If I am working on new work I always use sleeves, but my copper to iron taps are always soldered. Soldering is very simple and if practiced more on the small plants many a case of trouble would be eliminated. A clean joint, a hot iron and a little soldering paste will solder anything outside, but for instrument and main frame work I use resin core solder. If it had not been for my blow torch and solder our venture would have been a failure as we did not have the money to rewire the plant. We had about 200 miles of metallic circuit. Of course there were other things that were important, but the soldering most of all. I say and will continue to say that the soldering iron and blow torch are my best friends I have in my work.

Contributed

**Read all other books—philosophy, poetry, history, fiction; but if you would refine the judgment, fertilize the reason, wing the imagination, attain unto the finest womanhood or the sturdiest manhood, read the Bible, reverently and prayerfully, until its truths have dissolved like iron into the blood.—Rev. N. D. Hillis.

Telephone Storage Batteries

By RAY BLAIN

The power plant can be termed the "heart" of any modern telephone system, for should it fail every telephone in the entire exchange would immediately cease to function. The power requirements being so exacting that current must be supplied 100 per cent of the time can best be accomplished by the installation of a storage battery of adequate ampere hour capacity, necessary generators or rectifiers and primary power supply which is usually alternating current.

It is quite necessary that the battery be large enough to act as a reserve and to supply energy to cover the ordinary power failure. Commercial power in the average community today is fairly reliable, but if it cannot be relied upon it is best to install some type of gas engine-driven auxiliary charging set. In addition to the necessity of a storage battery to carry the system over failures of the commercial power supply, it is also invaluable as a noise killer as it acts as a damper to high frequency fluctuations caused by the voice and generator currents.

Were it possible to obtain some source of commercial power that was constantly available and by making use of a correctly designed compound wound generator, with suitable filters consisting of choke coils associated with large capacity condensers, preferably of the electrolytic type, an exchange could be operated without the use of storage batteries. This arrangement would not, however, at the present time prove a real advantage as the ordinary charging equipment and storage batteries are both reliable and can be maintained with less expense if the correct method of battery control be used. Though with the present rapid development and improvement in rectifiers and the increased reliability of the commercial power supply, it is hard to predict just what the power plant of future telephone systems will be. It may be possible that they will not not make use of storage batteries.

Care and Maintenance of Storage Batteries

In most telephone exchanges it is true that the storage battery receives excellent care, but in some the thought seems to prevail that it will last just so long anyway and that there is not any use in giving it much attention. It is quite common for a well maintained battery to give excellent service over a period of fifteen years or longer and still be in good condition. While in other cases I have known of a new battery being completely ruined in one or two years by careless maintenance. Probably the most common faults are excessive charging or allowing the battery to stand in an almost discharged condition for some time before again starting the charge.

Installation of Battery

It is a regrettable fact that too often batteries are installed in some dark damp corner in the basement that cannot be utilized for any other purpose.

Small glass jar batteries are usually installed in a cabinet which is satisfactory if the room is well lighted and the cabinet has suitable ventilation and so located away from walls with panels on each side that can be removed to permit a thorough examination of the battery. A suitable outside vent should connect from the top and one end of the cabinet to an air shaft or special chimney. Some means should be made at the bottom of the cabinet for the air to enter which will permit a free circulation at all times to carry away the fumes while charging and to keep the jars, sand trays and the inside of the cabinet dry. The vent should not be less than six inches in diameter. The inside of the cabinet should be well painted with acid resisting paint. The color is usually black but there has recently been perfected a white acid proof paint that is just as serviceable as the black and is much cleaner, improves the lighting and has a much better appearance in general. Black paint never looks clean but when white is clear everybody knows it. The small glass jar type cells are usually set in glass trays filled with sand, the purpose of which is to level the cells and distribute the weight equally over the bottom of the jar. Nothing except silicon glass sand should be used for this purpose as it is free from clay and other impurities usually found in ordinary sand.

A very good practice is to construct large lead lined trays of a size suitable to hold one shelf of the glass jars with their sand trays. This makes an excellent installation, is easy to keep clean and there is never any danger of the wood of the shelf becoming weakened as it is protected by the lead sheathing, from the acid spray.

Larger type lead lined cells or even the smaller glass jar type can be installed on a suitable rack in a regulation battery room. This room like the cabinet should be equipped with a suitable outside vent and if natural circulation of air cannot be obtained that is adequate to keep the room free of fumes and dry, then an exhaust fan should be installed to provide forced draft ventilation. The new style propeller type fan is excellent for this purpose and the motor is so encased that it cannot be damaged from the acid fumes. The room should be well lighted and all fixtures should be noncorrosive. If it is impossible to provide lead lined trays for the shelves of the cabinet or rack, then the wood supports should be acid proofed as much as possible before being painted. The following will be found suitable and will preserve the wood for a reasonable length of time. Mix and melt in an iron kettle; wood tar, 1½ lbs; rosin, 3 lbs.; powdered brick dust added to the above, 2 lbs. While wood treated with the above would be found suitable in most cases it is always safest to use the lead protection.

Methods of Charging

Batteries can be charged either by the "manually cycled" or the floating method sometimes called the "trickle charge system." Manually cycled method is the one that the gravity is permitted to drop a certain amount, usually from ⅓ to ½ of its complete discharge range before again being placed on charge manually. Hereafter in this article this method will be referred to as the "charge-discharge method."

With this system the regular charge is usually stopped after the gravity has risen to a point which is about five points below the maximum obtained on the preceding equalizing charge. With the charge-discharge system either the constant potential or the constant current method of charging can be employed.

The constant potential or constant voltage method is the one where the voltage is maintained at a constant voltage per cell. With this arrangement the value of the starting current on a completely discharged battery when the charge is first started will be considerable in excess of the normal rate. As the charge progresses and the voltage increases the current tapers until it is much below the normal rate at the end of charge.

The average current during the complete charge will be about equal to the normal rate. The maximum voltage at the terminals of the battery should not exceed 2.4 volts per cell or a minimum of less than 2.2 volts per cell and an average of about 2.3 volts per cell should be maintained. With the voltage of 2.3 per cell a battery can be placed on charge after it has reached any point of discharge and will automatically receive the correct charge without excessive gassing

The Finest Magneto

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American Electr

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to Venezuela . . . earns Confidence!

"If a man can write a better book, preach a better sermon, or make a better mouse-trap than his neighbor . . . the world will make a beaten path to his door."

ST. JOHNS! Cristobal! Maracaibo! Up and down the three Americas, in one short year, Prettyman quality and service have won consumer acceptance . . . good will . . . confidence. No romance of industry, this. No tale of magic marketing methods or farflung exploitation. Just honest quality and service. Dollar for dollar value in Prettyman Preserved Timbers, Ties, Poles and Piling. Quality Southern Pine, efficiently impregnated with high grade creosote oil to prevent decay.

In the twelve months since this complete and modern plant made its first shipment, it has made friends and customers of many of the biggest and most careful buyers on the continent. The United States Government. The Pennsylvania Railroad. The Canadian National Railways. The Southern Railway System. The Standard Oil Company. The Postal Telegraph and Cable Company. The Gulf Refining Company. The Sinclair Refining Company. The United Gas Improvement Company. The Southeastern Power Company. The Potomac Electric Power Company. State highway departments. And hundreds of others.

J. F. Prettyman & Sons will continue to deserve this confidence.

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or will it reach a temperature high enough to cause harm.

With the constant current method, the current is held constant by some means of control usually the field rheostat if a motor generator charging set is used. Adjustment of this rheostat as the charge progresses keeps the current constant as the voltage increases. With this method the battery is usually charged at the normal or eight hour rate until gassing starts and after all cells are gassing freely, when it is reduced to a much lower value called the finish rates. This rate is usually about 40 per cent of the starting current. The charge should progress at the finishing rate until the battery starts to gas freely again.

If the charge-discharge method is to be used I personally prefer a modified constant potential method of charging. This can be accomplished by simply inserting a suitable resistance in series with the battery or some other arrangement that will limit the current at the start of charge. This is cut out of circuit later after the voltage has built up and the current is permitted to taper to the end of charge. This avoids the possibility of excess gassing at any period which wears away the active material and reduces the useful life of the battery.

The Equalizing Charge

Regardless of which of the former methods of charging is used it will be necessary to give the battery an equalizing charge at fixed intervals. A simple safe rule to follow is to make this charge weekly if the battery receives a regular charge daily and each two weeks if the battery is charged less than daily. If the battery is charged only once per week or less, then make each charge an equalizing charge. This charge should be continued until neither the specific gravity or the voltage shows an increase over a period of five readings of the pilot cell taken at fifteen minute intervals. The object of this charge is to bring up cells which have fallen below normal on the regular cycles of charge or discharge. If the equalizing charge is properly conducted and the battery is in good condition the gravity of the different cells should not vary over five points between the highest and the lowest. It may be necessary to slightly overcharge some of the hig cells in order to bring up the low ones to the required level. This accounts for the equalizing charge formerly being called the overcharge.

Trickle Charge Method

In the past it was usually considered necessary that a battery of the lead acid type receive its regular cycles of charge and discharge to insure its maximum life and service. It is just recent that storage battery manufacturers have started to recommend that their batteries receive the smallest amount of charge and discharge possible. They have found that if this method is followed the better the service given and the longer the life of the battery.

In the old days it was common practice in some exchanges to float the battery during the peak load hours, but the charge was cut off during the hours of light traffic so that the battery would receive the proper discharge. A modification of this old floating method is rapidly becoming popular in the telephone field and in all probability will soon replace all other methods of battery control. The floating method or trickle charge as applied to telephone storage batteries is one where the charging source is connected to the battery continually and which maintains a constant potential across the battery terminals which automatically replaces any current expended by the battery and keeps it fully charged or nearly so at all times. This arrangement holds the amount of charge and discharge of the battery to an absolute minimum. With the charge-discharge method after the battery has been permitted to discharge ⅓ to ½ of its total capacity it should be of a large enough size that it would still have a reserve to carry the exchange over a failure of the primary power supply that might occur at that time. It is quite evident, therefore, that with the floating method that the size of the battery can be reduced from ⅓ to ½ and still maintain the same margin of safety as with the charge-discharge method.

With the manual control system it is almost impossible to avoid excessive gassing at times while the continuous floating method and its small amount of charge and discharge there is very little if any gassing. This reduces the waste of the active material to a minimum and consequently increases the life of the battery to the highest limit. The power cost will also be materially decreased as there is practically no current wasted.

Regardless of which method of control is employed the battery must receive the proper attention. Daily readings must be taken and recorded so that any falling off of certain cells can be immediately noted and corrective measures promptly taken. The electrolyte must be maintained at a proper level of from one-half to three-quarters of an inch above the top of the plates by the addition of pure water. It just takes a few minutes each day to insure that the battery is doing as it should and it should never be neglected. Often just a few days' neglect will cause lasting harm to the battery as trouble will soon go beyond the corrective stage. If wood separators are used they should be watched carefully and just as soon as they show signs of weakness they should be replaced as they are cheap and it does not pay to run any chances with poor insulation between plates. Like the proverbial chain which is no stronger than its weakest link, neither is a storage battery any better than its poorest cell.

New Device Gives Telephone Number

A special to the Christian Science Monitor from Oakland, Calif., says a device whereby the telephone user may leave his number for the party called is the invention of Arthur Engelberg, 81, a bookkeeper of this city, and promises solution of a trying problem.

The device, a tape recording machine, is attached to an ordinary telephone and, utilizing the wires and electric current of the telephone lines, the caller, by means of a key, can perforate his number on a reel of tape at the other end. A miniature lamp on the key stand tells when the device is operating.

The inventor declares that the mechanism, which is operated by a set of clock gears at the receiving end, could be used by the subscriber, or the telephone operator at the subscriber's request. He believes that it would save a great deal of time in business, assist the telephone company by obviating repeated calls, and in addition provide a welcome aid to the householder or shop owner who is forced to be absent at frequent intervals.

Gulf States in Texas Has New Exchange Building

The Gulf States Telephone Company has completed a new exchange building at Troup, Texas. New equipment has been installed and that town has one of the best equipped exchanges in the state. R. B. Still of Tyler, Texas, is general manager of the Gulf States Telephone Company, operating in a score of Texas towns.

Illinois State Telephone Convention to Meet November 8th and 9th

The Illinois "Progressive Convention" has arranged to hold its convention at the Hotel Abraham Lincoln, Springfield, November 8th and 9th, 1928.

Plans are under way to make this a convention of interest for both days. All unnecessary matter will be eliminated and a program of education is promised.

Telephone System Expanded

Mutual Telephone Co., operating automatic telephone systems on several islands, is carrying out at Honolulu this summer a construction program to cost approximately $500,000. This includes the installation of new exchanges in various parts of the city, and the placing of numerous wire services underground, thereby eliminating poles.

LINE AND DESK

MORE PRACTICAL QUESTIONS AND ANSWERS

Here are some additional questions and answers, along the same lines as those in the July and September issues of TELEPHONE ENGINEER. As these are prepared before it is possible to receive answers from the offer in the September number relative to testing sets for magneto telephones we are not able to give the results of that offer.

Question G—How can I supervise the conversation of a subscriber, which is necessary sometimes? Our system is a common battery type and our lines on answering jack can be changed as we record them as panel and jack.

Answer—If you have one or more subscribers to supervise and do not wish to do this through the monitor or supervision wires, I would suggest running a pair of wires from your office to the main frame, tapping on the subscriber's line. At your office end terminate them on the master springs of a key—onto the front springs of the key connect one (primary) winding in series with a 1 M. F. condenser, to the other winding (secondary) you can bridge two or three receivers for supervision. The key will be normally open; when you throw the key over it will cut in your supervision.

Question H—We took some ringers to the city and had them tested. They all tested 1,600 ohm and the magnets are good; the armature will stay on either pole piece you put it, however, when you ring them they will strike one bell good but hardly touch the other. What is the matter?

Answer—The trouble in your ringer coils is due to short circuited turns of wire. Lightning may have entered the ringer windings and burned the end layers of some of the coils together. This trouble would not show up on a resistance measurement at all times; for instance when the ringers were new they may have had a resistance of 1,604 ohms, and if they showed 1,600 ohms resistance when you had them measured this would leave a margin of 4 ohms of short circuited winding which if it was on one coil it would lower the efficiency of the ringer on a loaded line.—Contributed by A. Windsor McKay.

CONDUIT SUPPORTED ON POLES

Rebuilding of bridges provides many difficult engineering and construction problems for the telephone man, especially where older bridges which carry ducts for underground cable are replaced by new. Various means are used for supporting the ducts but it remained for a conduit foreman in Connecticut to find the place where he had to support the subway on poles. The subway consisted of four ducts of creosoted wood suspended by hangers beneath the floor of an old bridge, says *Long Lines*, to whom we are indebted for the description of

the situation. It was not possible to support the conduit from beneath as it would be in the way of construction work on the new bridge. The foreman found a sixty-foot pole which he supported on two shorter poles and so spanned the brook over which the bridge was being placed. The conduit was then lashed to the sixty footer by loops of steel strand. As the concrete deck was poured, fixtures of strap steel were inserted by which the conduit was supported after the bridge was finished.

"WAY BACK WHEN"

Back in the days when competition was the general rule, our manager got a contract from a subscriber of the opposition company. As things were not coming our way very well, we were right on the job to make the installation. I got to the house before the other telephone was taken out, and as the people wanted our telephone in the same place, I took down the other instrument and mounted ours in its place. I pulled the other wiring out of the entrance hole and pulled our wire through the same hole. The job was not quite done at noon and I was late getting back to it on account of a couple of cases of trouble. When I got back I found the opposition telephone had been removed, our wire was pulled back out of the entrance hole and the hole was neatly plugged up. On top of the telephone was a card with the following written on it: "That was our hole. Please bore one of your own. The Bogus Boys."—Contributed.

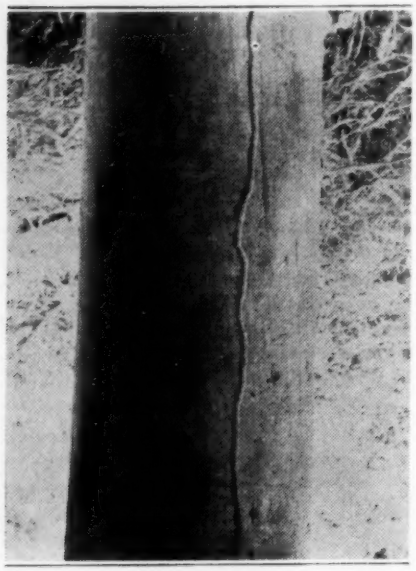
FIGHTING THE TERMITE

From the accompanying illustration it would appear that when the termite, or white ant, makes up his "mind" to change his place of abode from the lowly earth to more desirable quarters he works on the theory that "Where there's a will there's a way." In this particular case, when a pressure creosoted foundation post obstructed his passage he built a tunnel, or shelter shed, of earth and excrement through which he traveled upward unmolested. Termites build these tunnels over other impenetrable material also, metal, stone, brick or concrete, and if the lumber above the foundation is untreated they soon begin its destruction. Untreaetd wood in contact with termite-infested ground affords these insects easy access into the building.

The habitat of these termites was formerly limited to the tropical regions, but is rapidly extending into more northern regions, and they destroy hundreds of thousands of feet of lumber in this country annually. Untreated posts and poles are also frequently destroyed by them. The United States Bureau of Entomology has made a very thorough study of these insects, their habits, and methods of combating their attack. As a result of this study, Dr. T. E. Snyder, senior entomologist of the bureau, urges the use of properly treated timber in buildings where there seems any possibility of termite attack, recognizing and recommending for this purpose the two standard preservatives—coal-tar creosote for treatment of all timbers in contact with the ground and either coal-tar creosote or zinc chloride for treatment of other timbers in the building. Zinc chloride only is recommended for treat-

ment of wood to be painted or for portions of the building where the odor or color of creosote might make it undesirable.

Attention is also called by Dr. Snyder to erroneous statements of promoters of certain so-called preservative materials that the value of their products has been proved by Government tests where coal-tar creosote was a failure. He warns against the claims of these promoters, some of whom even go so far as to say that a surface treatment with their product will be effective. No treatment, even with the preservatives recognized and recommended by the bureau and by the wood-preserving industry itself, will be effective that does not penetrate the wood thoroughly, and this can be accomplished only by impregnation.



Courtesy, U. S. Bureau of Entomology
Termites Refused to Enter This Creosoted Foundation Post But Built a Tunnel on the Outside Through Which They Traveled in Search for More Palatable Material

The creosoted foundation post illustrated is in a building erected in a termite-infected region to determine the effectiveness of preservative treatment against the attack of these insects. Both coal-tar creosote and zinc chloride were used for treatment of portions of this building not in contact with the ground, and both preservatives are proving very effective.

HELP—HELP—HELP

A reader asks help on the following problem: "We have a pole yard which we have been using for many years. Both old and new poles are stored there. Some of the new poles, northern and western cedar, have been in the yard up to two years. We have noticed that a number of them are showing dry rot on the upper portions but the butts, which are treated, are OK. We understand that the decay is caused by fungus which travels from the old, rotten poles to the new ones, and are planning on clearing out all rotten timber as far as possible. As we will have to keep the yard in the same place, we would like to know if there is some way of disinfecting to kill the fungus and prevent further rot on the new poles or to prevent decay when we get a new supply of poles."

There are a great many telephone companies that have the same difficulty. The idea of clearing out the yard and removing all rotted timber is good. If there is some way of disinfecting the place it will also help but will be effective only if rotted timber is kept away from the yard. Perhaps some of our helpers who have met and solved this problem can give suggestions.

Fall Meeting, Northern Indiana Telephone Association

The annual fall meeting of the Northern Indiana Telephone Association was held at Nappanee, Ind., Thursday, Sept. 20. It was at Nappanee, in June, 1913, that this association had its inception, and Mr. Claude R. Stoops, manager of the Nappanee Telephone Company, was one of the several independent telephone men who saw the need of organized efforts and associations, and was instrumental in the forming of this association.

The meeting was called to order at 10 a. m. by President Roscoe D. Pontius of Rochester with about one hundred managers, operators and others present. Under the guidance of Mr. Stoops a tour of inspection, lasting about one hour, was taken of the various Nappanee industries.

Upon returning, President Pontius called upon Mr. Stoops who gave an address of welcome and also introduced a very talented young lady of Nappanee who gave an appropriate reading. Mr. Sam Tomlinson of Plymouth was the first president of this association, so the chairman called upon him to respond to Mr. Stoops' remarks. He urged the necessity of continually getting together, trading ideas and further improving our knowledge of the telephone business.

Following Mr. Tomlinson's remarks, the secretary read the minutes of the first meeting of this association, which brought back the past to many of those present, especially as they concerned the bitter strife between the Independents and the Bell in those days.

All present then adjourned to the Hotel Koppes where a fine dinner was served. During the meal Hon. Henry A. Barnhart, president of the Indiana Telephone Association, delivered one of his fine, inspirational talks, and Miss Catherine Rickhert of Nappanee favored with violin selections.

The afternoon session opened with a joint meeting of all present at which time Mr. W. H. Beck, secretary-treasurer of the Indiana Telephone Association, delivered an address on "Public Relations" that was very much worthwhile. He spoke of public relations in terms of interest and compound interest, bringing out many convincing arguments in favor of the best of public relations.

Following Mr. Beck's address the operators adjourned to their own conference with Miss Martha Hossler of Nappanee in charge. Three fine papers on traffic subjects were read and discussed and the new operating practices were explained by the Indiana Bell traffic officials who were present.

President Pontius acted as chairman of the men's meeting. Mr. Earl Daniel of Winamac gave a very interesting talk and demonstration relative to the "Care and Maintenance of Central Office Equipment." "Plant Accounting for the Small Plant" was the subject assigned to Roscoe Pontius, and during his remarks he used charts and sample forms to bring out various points relative to plant accounting and impressed those present that good plant accounting is an absolute necessity and that the men doing our work in the field or directly in charge of it must be properly instructed and educated in order that they may be able to make an intelligent and correct report of the work accomplished. The meeting closed following a round table discussion.

Fifty years ago, on December 1, 1878, the first central telephone office in Washington, D. C., was opened.

The Importance of Good Transmission

Some of the Causes of Poor Transmission and Methods of Overcoming Them

By CHRIS D. STEWART

Transmission is the largest item a telephone company has for sale. The term "service" is usually used, but what is telephone service but the transmission of intelligence? So, after all, service is largely a matter of transmission.

There are four items which make up good transmission. Good sending apparatus, good insulation, good conductivity of the circuit between the two points and good receiving apparatus.

A failure or partial failure of any one or more of these items will make transmission impossible or cause it to be seriously impaired.

In cases of poor transmission, the sending and receiving apparatus should be checked for defects, and the circuit also checked for the proper insulation and conductivity.

Most telephone men are under the impression that in order to do this, expensive instruments and highly technical men are required. However, there is an inexpensive instrument that can be used for this purpose by any practical telephone man.

With this instrument the transmitter can be tested, the receiver, induction coil, hook switch, battery, receiver, and receiver cord can be checked. The switchboard circuits, including cords, can be checked and the relays or drops tested for the proper resistance, etc.

The details of making these tests will be taken up in a future article and we will pass on to the details of line testing.

As above stated, the two main items which effect the transmission of a circuit are insulation and conductivity. If the insulation and conductivity of a circuit are good, the circuit will give the grade of transmission for which it was designed, otherwise it will not.

In case it does not, either the conductivity is poor or the insulation has broken down. In either case it is often hard to locate the trouble as it can be anywhere between the sending and the receiving station.

We will take up line testing first because it is subject to the elements and the cause of more trouble than other parts of the plant.

Poor insulation may be an actual breakdown of the insulation or a loss caused by faulty apparatus such as low drop or ringer coils or coils that are partially shorted. The location of this trouble is sometimes very difficult and will be taken up in a future article.

This brings us to the testing of conductivity of the outside line circuit.

To be practical an instrument to be used for this purpose should operate on one regular dry cell for the following reasons:

It is always accessable, has a low internal resistance, long life for this purpose, will not dry out quickly, and will not freeze out on cold days as a small battery will.

The instrument should be direct reading in ohms and simple to operate so that the average telephone man can use it. It should be portable and rugged enough to stand a reasonable amount of rough use.

It is sometimes necessary to test the joints on lines (especially toll lines) without interfering with the service on the line. While this may require more of the lineman's time, in many cases the saving of what would be lost circuit time will pay for the extra time the lineman uses many times.

Bad joints that will often test zero on the average test board will show from 10 to 1,000 ohms when tested with an instrument of the above description, and as voice currents are low in voltage and current flow, this resistance would effect them.

The conductivity of the line is its electrical resistance and the electrical resistance naturally would be correct were it not necessary to put joints, test connectors, etc., in the line. Connections may be a better word, but where used with the adjective bad, the expression "bad joints" explains the situation very well.

We are now down to the subject of "bad joints" in outside line wire and we will try to go into detail as to different methods of locating them. "Bad joints," like anything else that is bad, are hard to eliminate, yet it must be done or someone's transmission is sure to suffer.

The oldest method of locating bad line joints was to just go and look for them. When the joints couldn't be let down, the lineman breathed a prayer that they would be good and passed on. This method is still in use today, although not very efficient or practical.

Another method is trying to determine by ear with a portable telephone the condition of sections of the line. While some linemen get to be what we call "sharks," and get fairly good results, the average lineman cannot do it, and the method is neither efficient or sure.

Another method is to use high priced measuring instruments, and usually when they are used the tester uses too much battery and burns out his trouble. This method is only satisfactory with a very good technical man at the instruments.

There is another method recently devised which is done with an inexpensive instrument that is so simple to use that the average lineman can use it and get as good results as the best tester. It operates on low voltage, one standard dry cell, so that it is impossible to burn out the trouble.

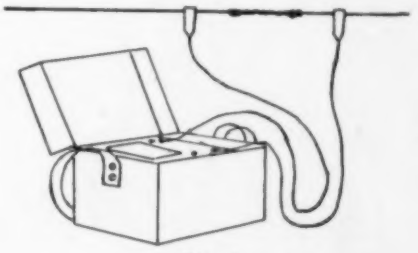


Fig. 1

The resistance readings are direct, the same as a voltmeter reads volts, and can be taken instantly. If the resistance of the joints varies, the reading will vary with it.

The resistance of a bad joint is usually caused by rust or errosion. Sometimes they vary, sometimes they are constant, and sometimes they come and go.

By burning out a bad joint, we mean the current breaks down the resistance of the joint and for a time it will be O.K. Sometimes it will stay O.K. for a day and sometimes only for a minute or two. A change of temperature or of atmosphere or for no apparent reason it will go bad again and you are ready for another wild goose chase unless a low

voltage is used for testing.

A detailed description of the new method is given below with some sketches showing the connections. A glance will show the simplicity of the tests.

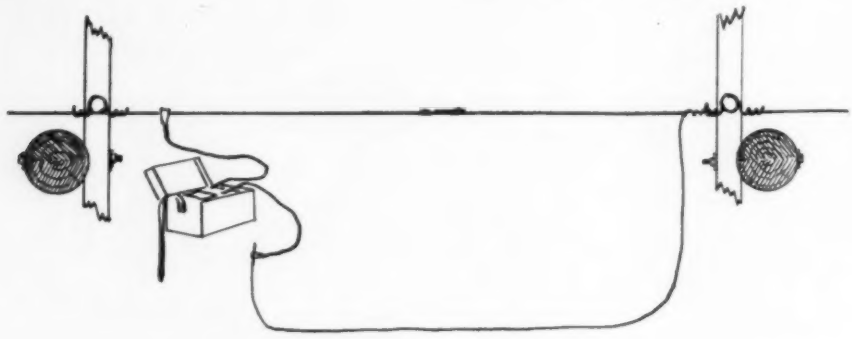


Fig. 2
Insulated wire length of span

Where a joint can be reached from a pole the instrument is attached as per Fig. 1, and the resistance read direct on the dial. If the reading varies or shows above zero, the joint is bad. If the reading shows zero and holds steady, it is good. If the joint is good, pass on to the next; if not, it can be repaired.

If a joint cannot be reached from a pole, a piece of insulated wire one span long can be attached to the wire under test at one pole and the wire and instrument taken up the next pole and any joint or joints in the span measured without interfering with the service on the line.

Fig. 2 shows the connection for this test.

In case of a metallac line whose service can be interrupted for short intervals, the line can be shorted at one pole and tested from the next. Or the line can be tested in one-half mile or mile sections in this way.

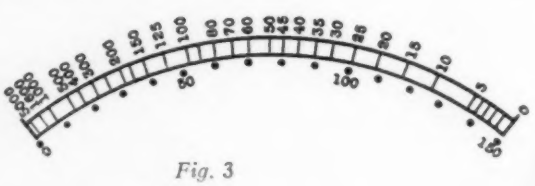


Fig. 3

The resistance of one mile of No. 12 iron is 33 ohms. This would be one-half mile of metallic circuit. One mile of No. 12 iron metallic circuit would be 66 ohms.

The resistance of one mile of No. 10 B&S copper metallic circuit is 10 ohms. Of course these resistances are to the nearest ohm, and will vary slightly with temperature changes, but not enough to effect the test. With the resistance chart sent with each of these instruments, the resistance of any size or kind of wire per mile is shown.

As iron wire ages its resistance increases slightly with age and in cases where old iron wire is being tested, a very good way is to short a half mile of circuit that has no joints in it and use this for a standard.

In addition to the above uses this instrument can be used as a 150-voltmeter, a battery tester, or for any use where a resistance measurement is required.

Fig. 3 shows a cut of the dial showing the resistance and voltage steps, and Fig. 4 shows a cut of the complete instrument.

In cases where lines are on poles that are not too high the instrument can be used from the ground.

Two three-cornered files may be attached to a piece of board about six or eight miles apart and the board attached to a long pole. Lead wires can be soldered to the handle ends of the files and brought down the pole to the instrument.

The files can in this manner be brought into contact with the wire, one on either side of the wire and one on each side of the joint. Now, by twisting the pole the files will be pressed against the wire and by swinging the butt of the pole back and forth lengthwise of the wire the files will bite through the rust or corrosion

Fig. 4

and the resistance of the joint can be read on the instrument.

Anyone desiring further information in regard to the above instrument may write Stewart Brothers, Ottawa, Ill., for bulletin on testing apparatus.

The city of Athens in Greece has only 1,800 telephone subscribers.

Phone Company Is Reorganized

Lima, Ohio.—Emmett R. Curtin, Sr., president of the Lima Telephone & Telegraph Co. previously to the sale of the property to the Utilities Service Co., was reappointed to the same post at a reorganization meeting held Tuesday afternoon at the company's office on South Elizabeth street. Curtin's appointment is for the remainder of the year.

Other appointments made at the meeting include that of G. B. Quatman to the post of vice-president, and O. J. Neuman, who served the company many years, to resident managership. Quatman will be in charge of operations at the local office.

The reorganization follows the sale of the Lima Telephone Co. in one of the most profitable transactions ever consummated in Lima. The purchaser, the Utilities Service Co., paid more than $2,925,000 for properties including the Lima company and those at Delphos, New Hampshire, Wauseon, Hamler, Ft. Jennings, Archibald and Napoleon. A profit of more than a million dollars over original cost was realized by Lima stockholders.

Telephone System Operated by Sisters Awaits Rate Hearing

Olympia, Wash., July—Owned and operated by two sisters, even to the extent of climbing poles and making line repairs, the Skagit River Telephone & Telegraph Company will be given a hearing at Concrete upon valuation, rates and service, the Department of Public Works announced today.

Mrs. Katherine Glover is president-manager, while her sister, Mrs. Nellie Wheelock, is secretary-treasurer and electrician. The line has 253 subscribers.

Telephone Company to Move to Dallas

Little Rock, Ark.—Headquarters of the Southwest Telephone Company will be removed shortly to Dallas for the sake of closer contacts with Texas and Oklahoma units of the system, D. T. Strickland, vice-president in charge of operations, announced Saturday.

With more than two-thirds of the system concentrated in Texas and Oklahoma, supervision from Little Rock has become unsatisfactory, Strickland said.

Madison Phone Co. Acquires Branch

Hayward, Wis.—Acquisition of the Wise Telephone Company of Hayward by the Commonwealth Telephone Company of Madison, operator of 66 exchanges throughout the state, was announced here. The local system served 750 telephones in Hayward, Stone Lake and Spring Brook.

32nd ANNUAL CONVENTION

of the

Independent Telephone Industry

by the

UNITED STATES INDEPENDENT TELEPHONE ASSOCIATION

Manufacturers' Exhibits. Special Division Programs. Pioneers' Meeting. Business and General Sessions. Reduced Rates on Railroads.

OCTOBER - 16 to 19

Hotel Sherman, Chicago

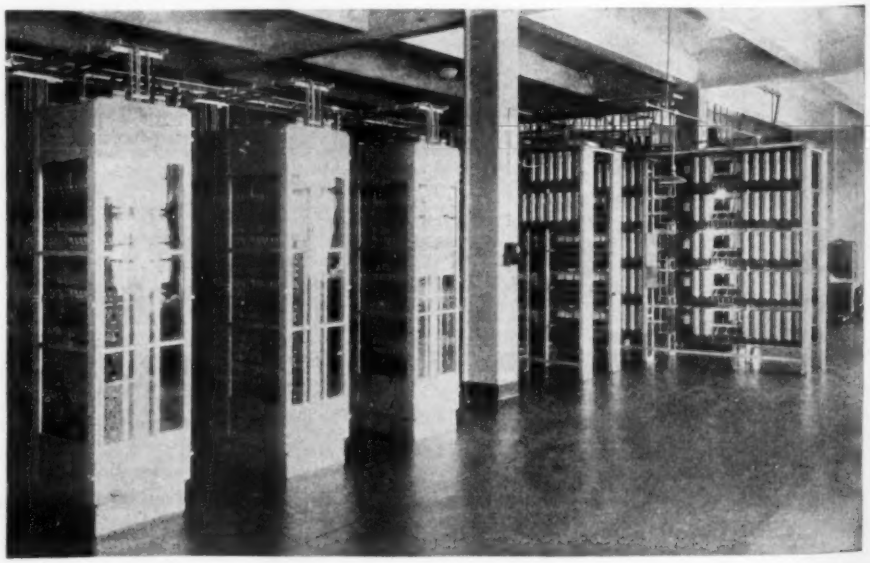
Santa Barbara, California, Has New Dial System

5000 Lines of Strowger Automatic Telephone Equipment Placed in Operation September 1st. Handsome Structure Housing New Equipment Modeled After Famous City Hall of Seville, Spain

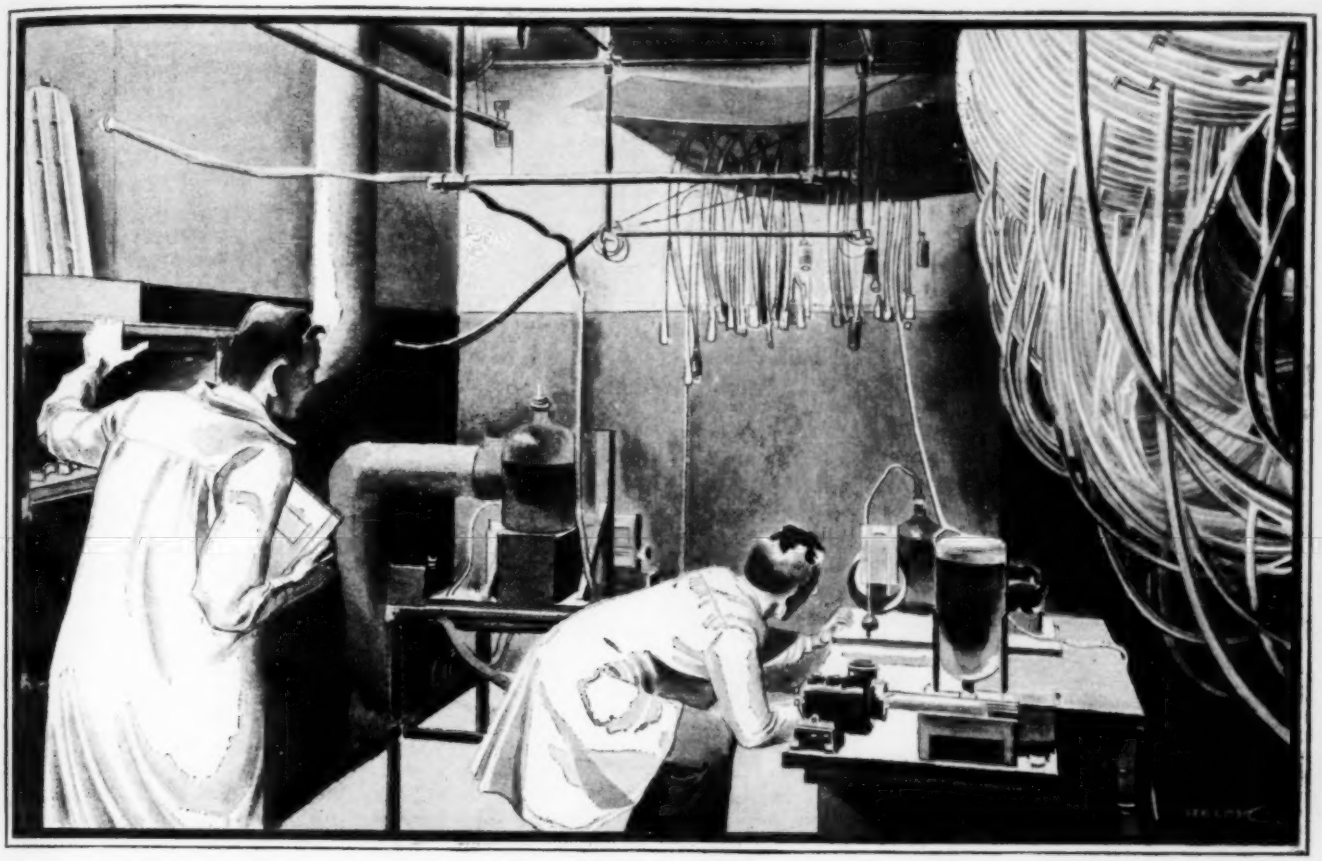
"Hello, is this the Morning Press? This is Mayor Finley calling the first number over the automatic system." These were the words of Mayor T. R. Finley of Santa Barbara, California, making the first official call over the city's new Strowger Automatic telephone system. More than 300 persons, including many prominent residents of Santa Barbara as well as officials of telephone companies in various parts of the state, heard him make the call. Following the brief ceremony, which was in charge of Daniel A. Sattler, vice president and general manager of the Santa Barbara Telephone Company, which signalized the cutting in of the automatic equipment, the visitors were served a luncheon on the floor below, accompanied by appropriate entertainment. Among the Santa Barbara residents present were Councilman S. W. Gruner and Mrs. Gruner, Councilman W. B. McIntosh and Mrs. McIntosh, Police Commissioner George Giovanola, Sheriff James Ross, Postmaster J. B. Aickard, Fire Chief A. H. Cooley, Robert E. Easton, president of the telephone company, and R. R. Walbridge, district manager of the Southern California Edison Company. Telephone officials from other communities included Arthur B. Fry, telephone and telegraph engineer of the California railroad commission; Charles F. Mason, vice president and general manager of the Associated Telephone Company of Santa Monica; J. S. Murray and H. E. Conlee, representing Automatic Electric Inc. of Chicago, which company manufactured and installed the new equipment. Other groups present represented the Pacific Telephone & Telegraph Company, the Southern California Telephone Company, the Western Electric Company and the Graybar Electric Company. The directors of the Santa Barbara Telephone Company are Allen L. Chickering, Robert Main, George S. Edwards, W. G. Griffith and Robert E. Easton. The installation work was ably carried out by a crew of expert installers in charge of V. L. Bunkleman of Automatic Electric Inc., Chicago.

New Home of the Santa Barbara Telephone Company at Santa Barbara, California

The new building of the Santa Barbara Telephone Company is designed in accordance with the best traditions of Spanish architectural art, following in its general lines the city hall of the city of Seville, Spain. An interesting historical significance is found in the fact that, at the time when the city of Seville was erecting



General View of Strowger Automatic Switchroom at Santa Barbara, California



5000 people whose sole job is bettering your service

An Advertisement of the
American Telephone and Telegraph Company

THE very nature of the telephone business necessitates a single interconnected system. The American Telephone and Telegraph Company accepts its responsibility for a nation-wide telephone service as a public trust.

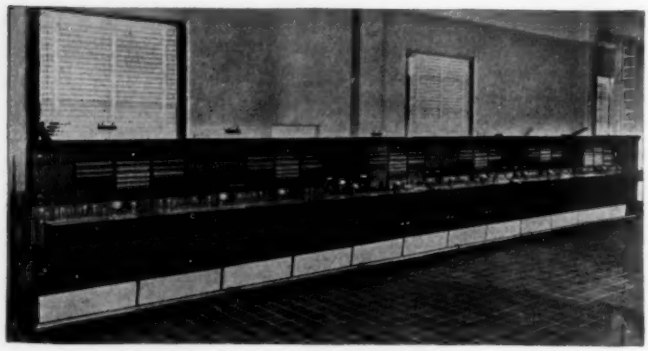
It also accepts responsibility for the safety of the funds invested in it by more than 420,000 persons in every walk of life. From the time of its organization it has never missed paying a regular dividend, so that investors rightly feel assurance in providing money for the growth of the business.

It is the policy of the company to use all income, beyond that necessary to pay regular dividends and maintain a surplus for financial stability, to improve and extend the service. Because of the nature of the business, speculative profits have no place in it.

The Bell System maintains in its research, engineering and business staffs and in the Bell Laboratories 5000 workers—in a total of 350,000 employees—whose sole occupation is to improve the telephone art and to make these improvements instantly available throughout the nation. These workers are a guaranty of continued progress in furnishing the public a constantly improving telephone service at the lowest possible cost.

its now famous city hall, a Spanish explorer was charting the unknown coast of upper California and claiming it for the Spanish crown. While at present the building consists of only two stories, the foundations and columns were planned of sufficient strength to support a third story, which will be added later.

The highest type of fireproof steel construction has been used, with outer walls of terra cotta of special texture and finish. The two entrance ways, the main portal on Cañon Perido street, and a side entrance on Chapala street, are richly and elaborately decorated in Spanish Renaissance style. The first floor contains the public lobby, cashier's office, pay attendant booths, commercial department, a retiring room for women employes, directors' room and executive offices. Outside the main entrance are two local and long distance telephone booths for the convenience of the public when the building is closed. The ceiling decoration in the public lobby is particularly interesting, being derived from the Royal Chapel of Santa Agueda in Barcelona and from the sacristy of the cathedral of Terragona. A pleasing tone of orange and yellow combined has been used for the walls. Clear wire glass has been used extensively throughout the interior for the prevention of injuries to employes by breaking.



10-Position Toll Board Manufactured and Installed for the Santa Barbara Telephone Company by Automatic Electric, Inc.

The basement contains the storage battery room, a repair department, a large supply storeroom, a vault for the storing of records, the heating plant and the cable vault. There is also provided for use in case of failure of the commercial power supply, an emergency gasoline engine generator set of 150 ampere capacity at 50 volts, for charging the storage batteries. The cables from the outside are all brought into the basement, through the cable vault, and from thereto the various ducts that terminate in the splicing pit on the second floor.

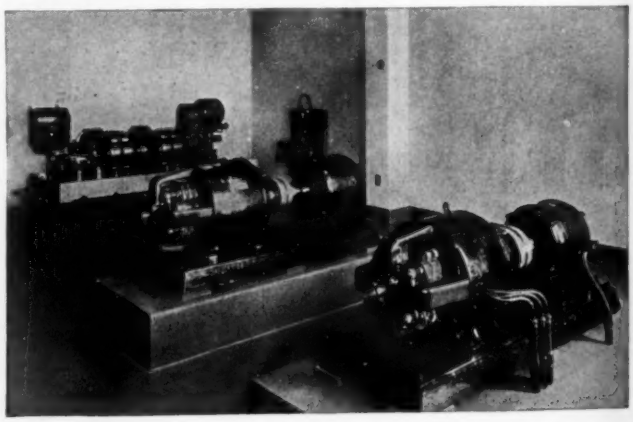
The second floor contains the Strowger Automatic equipment. There are 5,000 lines of this equipment installed, which used, with no secondary lineswitches. The lineswitches are mounted separately in 200-line units. (The connectcords are also mounted in separate boards.) Both an M. D. F. and a line I. D. F. have been provided, which makes a very flexible arrangement for interconnections. Provisions are made for 2,050 single provide service for some 11,600 telephones. Rotary primary lineswitches are lines, 2,200 two and four-party lines, 200 prepay paystation lines, 500 P. B. X. lines and 50 party lines for eight-party service. One special lineswitch board is provided for these latter, with ten-party frequency selecting connectors mounted on the rear.

The ringing current will be furnished in frequencies of 16, 33, 50 and 66 cycles, with provisions for 25 cycles current to be added later. To supply this current two ringing machines have been provided, one operating from the commercial supply of 220 volts, 50 cycles, 3 phase, and the other a duplicate machine operating from the storage battery supply in case of failure of the commercial current. The machines are equipped with interrupter attachments for the various tones. These interrupter springs also provide timed impulses which will be used for various time intervals in connection with the supervisory alarms, and will eliminate dashpot relays entirely from this equipment.

The power equipment consists of one 200-ampere motor generator set, one 80-ampere motor generator set and one 50-ampere rectifier, all to operate from the commercial current of 220 volts, 50 cycles, 3 phase. These will maintain the storage battery on a full float basis. In addition, there is provided the emergency gasoline engine generator set in the basement, which was mentioned before. There are also two 2-ampere rectifiers used to charge the 110-volt storage battery which furnishes current for coin collect purposes, and one 12-ampere and one 6-ampere rectifier used to charge the 130-volt battery used for telegraph purposes.

On the Chapala street side of the second floor is the large, well lighted long distance room. Here are installed the toll and special boards manufactured by Automatic Electric Inc. The toll board contains ten operating positions. They are of the latest design and provide for very rapid handling of toll cells. When a person dials the toll operator and gives her the necessary information for completing the call, he does not hang up to be called back later by the operator, but stays on the line while the operator completes the call. This method saves time for both the calling and called subscriber on a toll call and provides very rapid long distance contact. In addition to the toll board, there are a four-position information board, a two-position auxiliary service board and a one-position repair clerk's desk.

Three manual offices will operate in conjunction with the new Strowger Automatic exchange. These are Montecito, Goleta and Carpenteria. These will all be included in the same operating network, even though the communities are somewhat separated. Judging from the enthusiasm which the telephone users of Santa Barbara have exhibited for automatic operation since the cutover, plans for the future will include the consideration of further conversions to the dial method of operation. To quote Mr. Sattler on the success of the cutover—"We expected a number of trouble calls and considerable wrong dialing for a few days, but were surprised to find that the people almost invariably used the new phones like veterans, and there was more telephoning yesterday than usual. People appeared to want to use the new system to see how it worked."



Motor Generator Charging Sets and Ringing Machines at Santa Barbara, California

AMERICAN CROSSARM & CONDUIT CO.
14 Mills — Main Office—Chicago, Ill. — 38 Warehouses
Manufacturers and Distributors
CROSSARMS — FIR — Creosoted — Yellow Pine
Creosoted Wood Conduit
Pin and Brackets

Super-Service on rush orders!

If you are in a hurry your order can be loaded and on the way the same day we receive it.
Quality poles since 1882 assures you of guaranteed stock and satisfactory dealings. Let us quote you prices.
Northern and Western Cedar
With or without butt treatment
NAUGLE POLE & TIE COMPANY
59 East Madison Street, Chicago
Branches: New York, Columbus, Kansas City, Spokane Vancouver, Boston Yards: *Minneapolis, *Pinconning, Mich.; *Spokane, *Sand Point, Ida.; Vancouver, B. C. *Butt-treatment plants and Pentrex incising machines.

Naugle Poles

Bell Cedar Poles
Piling & Ties
Western Red - Northern White
Creosote Butt Treating—Any Specification
Guaranteed N. E. L. A., W. R. C. A., N. W. C. A. Grades
Treating Plants and Concentrating Yards
Minnesota Transfer, Minn., Newport, Wash.
Other Concentrating Yards at British Columbia Points
There Are No Better Poles Than Those Produced by
BELL LUMBER COMPANY
Security Building Minneapolis, Minn.
Long Distance Phone Atlantic 2304

Cedar Poles
Northern White Western Red
Plain or Treated Butts
Prompt Shipment from Minneapolis Yard.
T. M. Partridge Lumber Co.
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HUBBARD
GUY CLAMPS
X ARM BRACES
PINS
BOLTS
LAG SCREWS
WASHERS
GUY HOOKS
ANCHORS
GROUND RODS
TRANSPOSITION BRACKETS
HOUSE BRACKETS
DATING NAILS
GUY WIRE PROTECTORS
WRITE FOR COMPLETE CATALOG
HUBBARD AND COMPANY
PITTSBURGH
OAKLAND
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USE MORE
PATENT ANCHORS
CHANCE ANCHORS MAKE BETTER POLE LINES
A Type and Size To Meet Every Need
Specify CHANCE ANCHORS Your Jobber Will Supply you
CHANCE CO.
CENTRALIA, MO.

INSURE YOUR OVERHEAD LINES BY SPECIFYING
NORTHERN or WESTERN
CEDAR POLES
PLAIN or BUTT-TREATED
FROM
MacGillis & Gibbs Co.
120 E. Wisconsin Avenue,
Milwaukee, Wisconsin

REPUBLIC POLES
Northern and Western Cedar
Butt-Treating
REPUBLIC CEDAR CO., Marinette, Wisconsin

Single Interlocking and Multiple
Crosoted Wood Conduit
ZINC CHLORIDE TREATED LUMBER
W. C. MEREDITH CO. Atlanta, Ga.

"Telering"—A New Frequency Changer

Telephone engineers have been striving for years to develop a satisfactory means of producing alternating current for telephone signaling which would eliminate the defects inherent in the present methods and embody such characteristics as past experience has shown to be desirable. The requirements of major importance are that the primary source of power supply be the regular lighting circuit; that the first cost be low; that the unit be simple and compact; that it operate for long periods without attention or replacements; that the wave form be correct; that it be practically noiseless and the current consumption small.

To meet these specifications, a frequency-changer called the *Telering* has just made its appearance on the market and is attracting much attention. The principle on which it operates is novel and radically different from that of the present pole-changers and ringing converters. The construction and operation of this device is of the simplest nature, yet the results not only exceed those of complicated apparatus, but the desirable characteristics cannot be had with the present forms of reed-type interrupters.

There are numerous applications for this device, but that of telephone signaling only, is referred to herein.

The apparatus is composed mainly of a vibrating reed with an adjustable contact, a motor coil for operating the reed, a transformer, and tungsten lamps.

The reed is tuned to a natural frequency of 40 cycles per second for a primary current of 60 cycles. The action of the reed is that of a combination of two pendulums of different frequencies, controlled by a rigid contact placed about

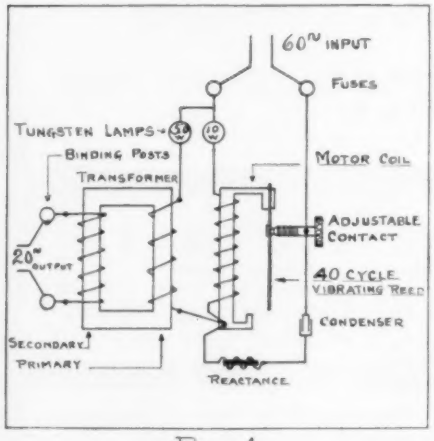


FIG. 1

¼ of the reed length from the suspension point and results in the contact being closed ⅓ of the period necessary for the reed to complete one cycle.

The motor coil serves to keep the reed in continuous vibration. A transformer is used to obtain the desired secondary voltage and to insulate the ringing circuit from the power circuit. The lamps act as compensators and are inserted in the motor coil and transformer circuits to limit and regulate the current in the respective circuits.

For telephone signaling one method of connecting the apparatus is shown schematically in Figure 1. A circuit composed of capacitance and reactance is shunted around the single contact to absorb the inductive discharge of the load circuit. There are two primary circuits connected to the power mains and one secondary output circuit. The first primary circuit includes the contact screw, reed, motor coil and compensating lamp; the second primary circuit includes the contact screw, reed, transformer primary and compensating lamp. The secondary circuit contains the transformer secondary winding only.

Each time the circuit is closed through the contact screw and reed, an impulse is sent through the motor coil and the transformer primary. The contact is closed when the reed is stationary and when current is applied to the power terminals the first impulse through the motor coil causes the reed to swing toward the coil and away from the contact screw, opening the circuit. The opening of the circuit de-energizes the coil and the reed swings back and again closes the contact. The contact being common to both of the primary circuits, each time the contact is closed an impulse is also sent through the primary winding of the transformer. In this manner the reed is kept vibrating continuously through the impulses in the motor coil and the transformer is excited with the same impulses.

Referring now to Fig. 2, the motor coil, reed and contact screw are so arranged that the reed can make a wide sweep in either direction. When the motor coil is energized, the free end of the reed is attracted toward the bent pole-piece on the end of the coil. At the start of this movement the contact is opened, but the momentum imparted to the reed carries it beyond the tip of the pole-piece. At the end of this stroke the reed swings back against the contact and again the momentum of the reed carries it beyond its point of rest in the opposite direction. In its sweep toward the motor coil, the reed is flexed at its suspension point and in the opposite direction, during the last third of its stroke, it is flexed at the contact point. During two-thirds of a complete cycle, the reed swings at a frequency one-half that of the remaining one-third and results in the contact being closed just one-third of each cycle of the reed. The reed is tuned to vibrate at 40 cycles per second and the contact is closed for one-third of each cycle so that the contact is closed

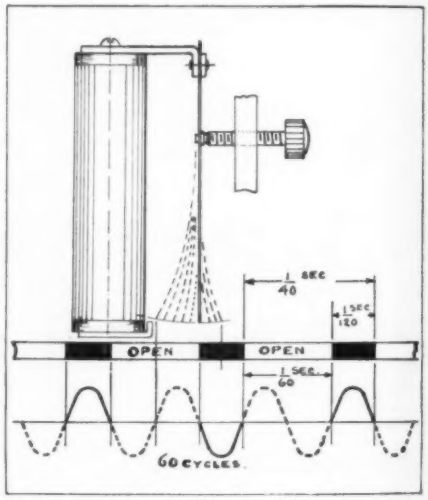


FIG 2

exactly 1/120th of a second for every third 1/120th of each second. Now, if a 60 cycle current (120 alternations) is applied to the vibrator unit, the contact will be closed during each third alternation (plus and minus) and will impress upon the primary winding of the transformer a characteristic 20 cycle current, the contact always opening and closing at zero potential.

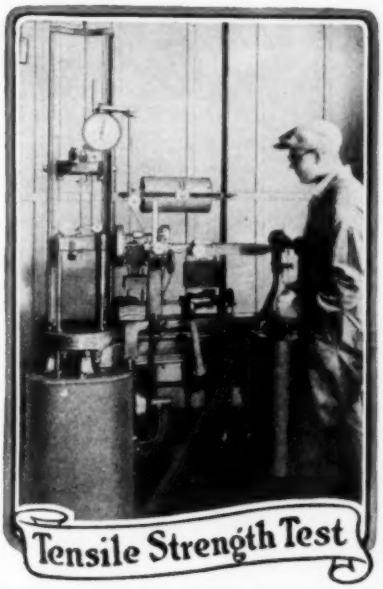
The adjustment is accomplished by backing off the contact screw until the circuit is open and the reed stops vibrating and then turning the screw slowly inward until a point is reached where the reed vibrates at its natural frequency (evenly), which condition is easily recognized visually. Because the reed is self-starting it will get in step with the line frequency immediately and remain so regardless of ordinary fluctuations. The contact depreciation is practically nothing and what little there may be over long periods will be due to mechanical wear and is readily taken up with the adjustment screw. Compared with the orthodox forms of reed-type con-

Crapo

Galvanized Products

Telephone and Telegraph Wire

Steel Strand



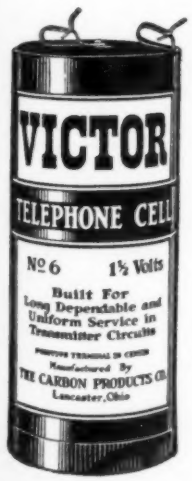
TENSILE strength combined with proper elongation are essential factors in line construction. Constant vigilance through laboratory tests makes certain that every wire measures up to the tensile values established by engineering research and long practice.

Crapo Galvanized Wire and Strand embody these necessary elements for long life and low maintenance. Insist upon **Crapo** Galvanizing! There is no substitute.

Representative Supply Jobbers are prepared to fill your requirements for **Crapo** Galvanized Wire and Strand on instant notice.

Indiana Steel and Wire Company

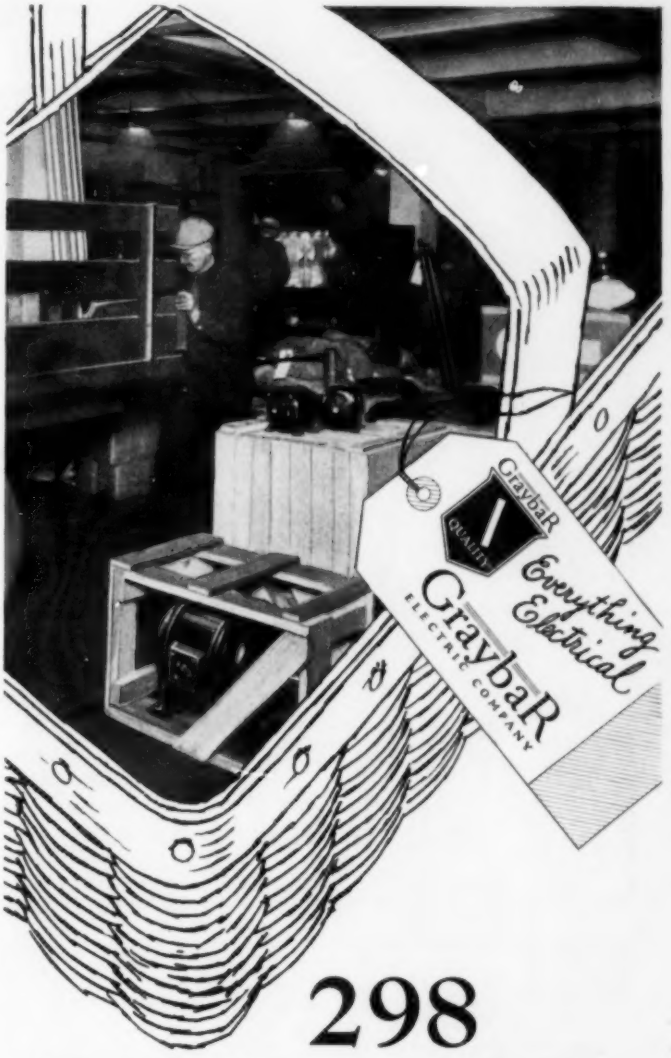
Muncie, Indiana. U.S.A.



VICTOR TELEPHONE CELLS

Uniform quality assures to you a lower average in replacement cost.

The Carbon Products Co
LANCASTER, OHIO
11 South La Salle Street, Chicago



298 electrical manufacturers fill it for you . . . . .

ONE makes lamps. Another makes motors. Another makes wire. Still others make cable and conduit.

In all, 298 manufacturers have filled the nearby Graybar distributing house, as if it were a vast market basket, with everything that you could possibly want in electrical supplies.

No reason, then, why you should go electrical marketing. Here is a substitute for your market basket—a substitute that will take all the problems out of purchasing whether you buy one or sixty thousand items.

GraybaR

Successor to *Western Electric* Supply Dept.

The Graybar Tag—Symbol of distinction

OFFICES IN 70 PRINCIPAL CITIES
EXECUTIVE OFFICES: GRAYBAR BLDG., LEXINGTON AVE. AND 43RD ST., NEW YORK

verters, this extremely simple adjustment eliminates the difficulties so frequently experienced, the average operator being as competent to make this adjustment as a maintenance man.

Short-circuiting any leads or terminals, except those of the power supply, does absolutely no harm and in this state it consumes only the amount of current taken by the lamps in the circuits, because the line supply is delivered through lamps and not directly into the primary winding of the transformer as is the usual arrangement.

In the operation of telephone bells, a clearer tone is had from the gongs through the use of this wave form, as illustrated in Fig. 3, for the reason that

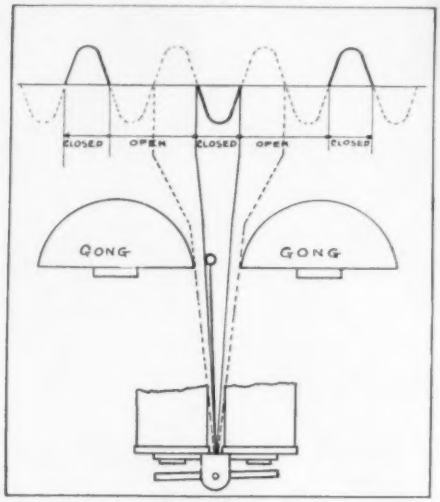


FIG 3

during the time interval between the 20-cycle lobes the bell hammer, due to momentum is being brought into contact with the gong and rebounding in the opposite direction, simulating piano-key action, and when the contact closes and an impulse is sent through the bell windings the hammer is already started in its proper direction, tending toward more perfect syncronism between ringing device and bells, thus producing a more satisfactory and pleasing signal. Each of the two gongs of a telephone ringer has a natural period of oscillation as does the ringer-movement itself and seldom are the three synchronized, therefore the gongs and ringer-movement should be free to oscillate at their natural frequencies, the exciting impulses acting only to keep the hammer in motion.

Furthermore, this wave form will not puncture cable and switchboard insulation, which is so frequently met with where the ordinary forms of vibratory interrupters are used.

The *Telering* has been developed with a full knowledge of what characteristics should be embodied in the ideal ringing converter. Its construction is such that the integral parts are self-contained units assembled upon a mounting plate which becomes the back wall of the containing cabinet. This cabinet is of steel, enameled, and presents a very pleasing

appearance, its size being only 12x9x5 inches.

Telephone Property Taken Over

Charlottesville, Va.—After twenty-four years as head of the telephone service of the city and Albermarle county, Fred W. Twyman, Thursday morning turned over the management of the Piedmont Telephone Company to its new owners, the Southern States Utilities Company, to which the property officially passed on Tuesday.

Cable-Splicers' Wiping Cloth a Time-Saver

A flexible finished wiping cloth for cable splicers is being marketed by Geo. E. Williams, 3 East 26th street, Minneapolis, Minn. This cloth is specially prepared for wiping soldered joints and needs no breaking in; it insures a uniform durable wiped joint on cable sleeves. This cloth is furnished in convenient strips and especially prepared, which has proven a time-saver wherever used. Write the above firm for prices and sample.

Welker Doing Good Business

J. H. Welker, the directory advertising man, who makes his headquarters at Canton, Ohio, but spends most of his time getting the signatures of prospective directory advertisers on the dotted line, is expected to be on the job during the national convention. Welker is just as enthusiastic over the landing of a contract from an advertising prospect as he was twenty or more years ago when he started on the job of making telephone directories pay their own way. A large number of telephone companies avail themselves of Mr. Welker's services and his visits are looked forward to both by the companies and the advertisers, who appreciate the service which he can give in framing up attractive and up-to-date advertising copy.

World-Wide Visual and Phone System Ground-Work Laid

New York.—The groundwork for the most comprehensive visual and auditory communication system in the world has been laid through the formation by International Telephone & Telegraph Corporation interests of International Communications, Inc., and International Cables, Inc. Both companies are designed to operate, own, lease and construct cable and telephone lines, radio broadcasting stations, television apparatus, commercial photographic transmitters, and radio telephone and telegraph system, in any or all countries of the world, including the United States.

The incorporation papers were filed in Albany by David W. Peck, counsel for the company and one of the five directors of the two new companies. The other directors are Howard L. Kern, Newark, N. J., counsel of the International Telephone & Telegraph Corporation; William H. Freng, Long Island, assistant secretary of International Telephone; Samuel Ordway and Franklin Hutchinson.

The charters granted to the new companies are of perpetual duration, but the context did not indicate what the precise operation plans of the companies are. International Telephone and Telegraph interests are reticent about the incorporations. It was pointed out, however, that the applications of incorporation, which in both cases were filed under articles 3, 4 and 5 of the transportation corporation law of New York, were exceedingly broad.

It was said that the new companies may not be subsidiaries of the International Telephone & Telegraph Corporation, which is the holding company for the vast communication system which has been built up since 1921 and was recently merged with the Mackay companies, which include the Postal Telegraph Co. and Commercial Cables. It may be decided, it was said, however, to make the two new companies subsidiaries in the International Telephone system. As the need arises the capitalization of the new companies can be increased.

The rapid growth in importance of the International Telephone & Telegraph Co., which is backed by J. P. Morgan & Co., has attracted a great deal of attention in Wall street in the last year and some development such as was made known today has been expected by "insiders."

Ready Pay Out Reel

Best on the Market.

No. 4-A Flat Perforated Base

As many as 12 of these can be placed on frame on truck for use at one time.

Write for Price List and Discount.

Ready Manufacturing Co.

Security Bank Bldg. Toledo, Ohio

STANDARD

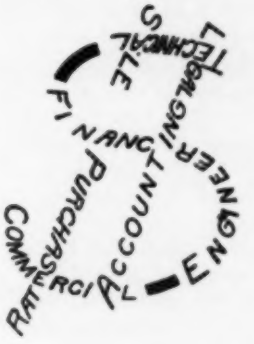
THIS name applied to telephone wires and cables means what "Sterling" does when applied to silver—a guarantee of quality recognized by all discriminating buyers.

Standard Underground Cable Co.

Division of General Cable Corporation

Pittsburgh, Pa.

OUR EXPERIENCE MEANS MONEY TO YOU



Tangle your problems as you will, we have the unique combination that solves them.

Combined engineering, accounting and legal ability, and experience.

SNOOK, MARTIN & CO.

40 WEST GAY ST.

COLUMBUS, OHIO

WARD H. SNOOK, M.E., E.E. LL.B.

GEO. MARTIN, M.E., E.E.

SHERMAN SQUARE HOTEL

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CONVENIENT

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QUIET

COMFORTABLE

EXCELLENT FOOD AT MODERATE PRICES

COURTEOUS SERVICE

SINGLE ROOM AND BATH $2.50

FOR TWO $4.00

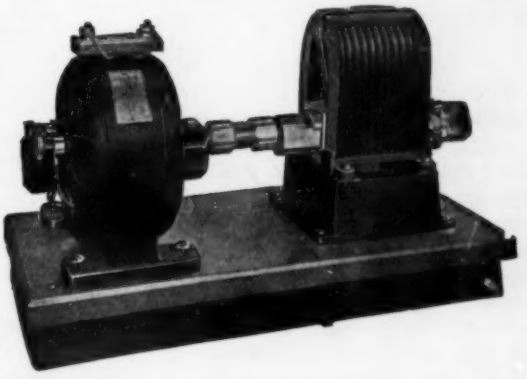
REASONABLE RATES

WIRE AT OUR EXPENSE

Holtzer-Cabot

Magneto—Ringing—Motor—Generators

GIVE DEPENDABLE RINGING SERVICE



Improve your ringing systems by installing Holtzer-Cabot Magneto Ringing Motor Generators.

Dispense with battery maintenance and constant service diligence.

This unit assures you a lifetime of trouble-free service at small initial cost.

Give it a thorough test in your exchange. You will be convinced. Complete data on request.

The Holtzer-Cabot Electric Co.

125 Amory St. Boston, Mass.

6161 South State St. Chicago, Ill.

Many rumors, either entirely or partly unconfirmed, have been in circulation regarding future plans of the company.

According to some sources the phenomenal strength of Radio Corporation of America on the stock market has been caused in part by International Telephone & Telegraph buying with a view to consolidation. The valuable basic patents and rights for the manufacture of radio equipment which the Radio Corporation controls has also been an incentive to I. T. & T. it has been reported.

Some months ago a report that Radio and I. T. & T. would be merged was officially denied. It was pointed out that such a merger could not be brought about so long as the White act, which specifically forbids the consolidation of American wireless and cable companies remains in force. Other sources said the White act was retarding American communication development and would leave Americans unable to compete with the extensive British communication combine. For this reason there was said to be a growing sentiment against the White act and that once it was repealed many of the large companies would consolidate into one system, which in time might possibly include American Telephone & Telegraph, International Telephone & Telegraph, the Mackay companies, Western Union, the Radio Corporation, and all the subsidiary interests of these companies.

A third new subsidiary of the International Telephone and Telegraph Corporation, the International Radio Company, has been formed by interests connected with the corporation. A nominal capitalization of $10,000 is provided for, similar to that of the other two new units, International Communications and International Cables.

The purpose of these three new organizations, it is understood, is to take over the operation of the telephone company's expanding system in the telephone cable and radio fields, a system which extends to many of the principal countries of Europe and throughout the South American Continent.

Negotiations looking toward making International Telephone the nucleus for a world-wide radio organization are believed to be well under way. Already it has built up a telephone system second only to that of the American Telephone and Telegraph Company, and through the acquisition of the Mackay companies it has brought into its organization the well known Postal Telegraph lines and the All-America Cables.

A recent analysis of the developments in the communication field, appearing in the "Granger Financial Review," of Sulzbacher, Granger & Co., says that "great strides are being made in building up a few world-wide systems of communications.

Ramblings

By J. A. S.

Two new vice-presidents have been named by the Southwestern Bell Telephone Company over at St. Louis. This gives that city three vice-presidents, all good men, too. We asked one Bell employe of another state why it was done and he replied that it was probably economy to give them titles rather than increases in salary. We don't believe it; these men probably got both—and they deserve it.

* * *

Fred M. Hoag was one of the men promoted. He's a faithful, hardworking cuss who believes in giving his company the best that is in him, and we believe the Southwestern did the wise thing in promoting Hoag to the vice-presidency. Fred has been commercial manager at St. Louis for some time, and we understand he will continue to head this department.

* * *

A. C. Stannard, general traffic manager of the Southwestern Bell at St. Louis, was the other recipient of promotion to vice-president in his organization and will continue to supervise this department. The growth of the telephone business was explained as the reason for creating these new official positions.

* * *

Warren Pratt, president of the Kearney Telephone Company, Kearney, Nebraska, has retired as president of his company and states that he plans to retire from business activities in so far as the telephone business is concerned. He is well known among the telephone fraternity and his many friends are glad to know that his efforts have been so well rewarded that he is able to go on the retired list.

* * *

Friends of TELEPHONE ENGINEER AND TRANSMITTER throughout the country are invited—and urged—to make our office their headquarters while attending the convention in Chciago. We'll run your errands, write your letters and furnish stamps, but don't ask us to show you the "night life" in Chicago. It's too dangerous.

* * *

The writer spent a day over at Elyria, Ohio, recently. Naturally when Friend Curran of the Elyria Telephone Company learned we were in town he dropped everything else and took us in hand; he showed us everything but the cellar. And Elyria can boast of a first class exchange building, equipment and management. We'd be tickled to tell you all about it, but words fail us in describing this well equipped automatic exchange—we will have to leave that to the engineers who designed it.

* * *

We came in for a round of kidding at the Jones et al. housewarming at Athens. It all started when Howard Leinard sent a line of misinformation to the chairman that we were an orator. After a few words, which probably sounded like Amos' famous Labor Day oration over WMAQ, another fellow (darn these salesmen!) told a group that I had a voice like Announcer XYZ of Blah station. To add further insult to injury, a brother with a kindly face said that I resembled former Governor Cox of the Buckeye state. This proved too much and we ducked for the cellar.

* * *

And Al Smith will speak in Chicago during the convention. Yes, we had considerable trouble in arranging this added attraction to the convention program, but when we finally got it through his head that this was a "hello meeting" and not a "helluva meeting," he readily consented.

* * *

Down in New York City twelve thousand people every day drop a nickel in the slot to find out the time of day. Whether they do this cheerfully or not matters little. This is a new source of income and other cities will probably adopt it.

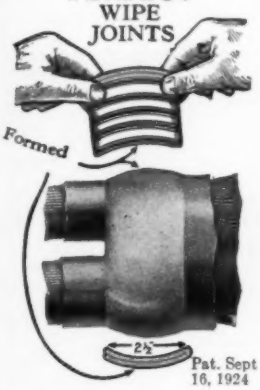
* * *

H. L. Harris over in Kansas City has had further honors thrust upon him. Though still in his prime, he heads some of the largest corporations of the country, and just recently he was elected president of the National Telephone & Telegraph Company, succeeding J. W. Perry, who was made chairman of the board. Mr. Harris is vice-president of Theodore Gary & Company, executive vice-president of the Associated Telephone & Telegraph Company, president of the Automatic Electric Company, president of the American Electric Company, and is director of other important organizations, as well as member of the board of directors of the United States Independent Telephone Association.

* * *

Melvin E. Houck, formerly general manager of Bellevue Telephone Company of Bellevue, Iowa, has acepted a position as commercial agent in the commercial department of the Home Telephone & Telegraph Company, Fort Wayne, Ind., it was announced by B. C. Schweitzer, commercial superintendent. Mr. Houck is widely experienced in all branches of telephone work and was a student at Iowa State University. He also was connected with the Iowa State

PERFECT WIPE JOINTS



Pat. Sept 16, 1924

FORMED—flexible—finished wiping cloths for CABLE-SPLICERS insure uniform durable wiped joints on cable sleeves. Ready for use. Need no breaking in.

Let me tell you why it is cheaper to furnish your cablemen with these cloths than to allow them to use the old style shapeless, unfinished cloths.

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Sole Manufacturer

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Blake Insulated Staples

Unequalled for telephone and bell wiring. The fiber insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for samples.

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BOSTON, MASS.

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Black and Gray Friction

Highest in Quality

Black and Gray Rubber

Meet All Specifications

No. 6 STORM KING Telephone Batteries

LINE HARDWARE HOT GALVANIZED

American Steel & Wire Co.'s Perfected Extra Galvanized B B. Iron Wire and Steel Strands

Fir Cross Arms—Pins—Brackets—Cedar Poles

Bare and Insulated Copper and Iron Wires

A. J. JOHNSON ELECTRIC COMPANY

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217 No. Desplaines Street CHICAGO, ILL.

The "STEWART" Cable Tester

Locates shorts, crosses, grounds and wet spots to an inch. Will often save its cost on one case of cable trouble.

Order a "STEWART" Cable Tester and be sure you are going to locate your next case of cable trouble quickly.

Any telephone man can use it. Not an instrument that only an expert can use.

Equipped with two vibrators and an indicating lamp. Write for circular.

Sent on 10 days' trial.

Also, Test Sets, Test Cabinets and Detecto-Meters.

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BATTERIES

With an Exide battery on the job, a long life of dependable, trouble-free service is assured. That is why Exides are so generally used by the telephone systems throughout the country.

THE ELECTRIC STORAGE BATTERY CO.

PHILADELPHIA

Exide Batteries of Canada Ltd., Toronto

Get EVER-PROTECT aid in your construction.

EVER-PROTECT has proved practical and profitable in making many hundreds of cable installations underground without a conduit. It protects cable against storm damage, corrosion, chemical action, electrolysis and abrasion.

In liquid form EVER-PROTECT is great for overhead work, protecting your cable and messengers against chemical action and other destructive influences.

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National Cable Compound Co.

Incorporated

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CONVENIENT TRANSPORTATION to EVERYWHERE

Adjacent to NEW YORKS EXCLUSIVE SHOPPING DISTRICT

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Personal Direction Of CHAS LA PRELLE

30 EAST 60th ST

New York

Telephone Company for several years.

* * *

J. C. Paxton of McAllen, Texas, has joined the hosts of benedicts and now finds it necessary to call the better half before accepting invitations for evenings with the telephone fraternity. September 5th, Mr. Paxton was married to Miss Mary Frances Davis of Teague, Texas,. Paxton is the general manager of the Rio Grande Valley Telephone Company, McAllen, Texas. He was formerly connected with the Grayson Telephone Co., Sherman, Texas.

* * *

Friend C. A. Vedder of the Southwestern Bell at St. Louis proffered the writer a ticket to the "world series" at St. Louis recently, for which we must extend our thanks, even though we were unable to accept his kind invitation to attend the game. Yes, it would have been a pleasure to attend the game; it is always a pleasure to eat, drink and be merry at the expense of the Bell.

Mr. James R. Kearney, Jr., of St. Louis, Mo., and Miss Barbara Berger of Flat River, Mo., were married October 1st and are spending their honeymoon in Colorado. Mr. Kearney is secretary and advertising manager of the Jas. R. Kearney Corporation of St. Louis and is well known in telephone circles. TELEPHONE ENGINEER, with hosts of others, offers congratulations.

Southwestern Bell Elects Two New Vice-Presidents for Southwestern Territory

The Southwestern Bell Telephone News will contain the following announcement in its October issue anent the election of additional vice presidents to care for the increased work out of St. Louis office:

To meet the demands of the rapidly increasing business, the directors of the Southwestern Bell Telephone Company have created two new vice-presidencies to which have been appointed Mr. A. C. Stannard and Mr. F. M. Hoag, effective September 15th. Both will report to Mr. A. B. Elias, first vice-president.

Mr. Stannard, for the last seven years general traffic manager of the Southwestern Company, will have charge of the engineering, plant and traffic departments. Mr. Hoag, who has been general commercial manager for the last two years, will be in charge of commercial and other associated activities of the company.

The heads of the Southwestern company believe that the problems of this organization and territory best can be met by co-ordinating the company's activities in much the same manner as is done in many modern industries, by assembling in one group those departments concerned with what might be termed production, and in the other those departments concerned with the marketing of telephone service.

In this way the work of the engineering, plant and traffic departments, the so-called production arms of our organization, are to be tied closer together under Mr. Stannard, while under Mr. Hoag will be grouped all of the contractual revenue, rate, development, sales, and association business activities and relations with the customers of the company, which, combined, go to make up the marketing end of the company's business.

Mr. Stannard was born in Greenfield, Mass., December 14, 1881. He entered telephone work with the American Telephone & Telegraph Company on October 1st, 1899. On April, 1901, he transferred to the New England Telephone & Telegraph Company at Springfield, Mass. Later he was with the Southern Bell

Fred M. Hoag
Vice-President of Southwestern Bell Telephone Co., in charge of Commercial Activities

Telephone & Telegraph Company and then, for a while, again with the American Telephone & Telegraph Company and then with the Pacific Telephone & Telegraph Company, always in the traffic department.

In August, 1918, he was transferred to the Chesapeake & Potomac Telephone Company as acting general superintendent of traffic and a year later was made general superintendent of traffic, at Washington. He held this position until he came to the Southwestern company in 1921.

A. C. Stannard
Vice-President Southwestern Bell Telephone Co., in charge of Engineering and Traffic Activities

Mr. Hoag was born at Akron, Ohio, April 10th, 1881. He did his first telephone work as a cable helper for the Cleveland Telephone Company in 1898. His employment at Cleveland continued until 1903, during which time he served as foreman of the cable department and as general foreman in charge of construction.

In 1903 Mr. Hoag joined the engineering department of the Southwestern company at Dallas and he became construction engineer in 1904. From then until 1920 he served in the following capacities: assistant plant engineer, construction supervisor, assistant engineer and construction supervisor, division superintendent of plant, plant superintendent, and, in addition, worked as evaluation engineer in rate cases and on other special assignments.

In May, 1920, Mr. Hoag went to Oklahoma City as general plant superintendent and state engineer, his duties being extended in October of the same year to include those of assistant general manager. In April, 1921, Mr. Hoag succeeded E. F. Carter, now president of the Ohio Bell Telephone Company, as general manager for Texas. On September 1, 1926, Mr. Hoag was appointed general commercial manager for the Southwestern company.

"I bought a new model loud speaker yesterday."

"What hoarse power?"

"I'm a mute."

"You don't say."—Penn. State Froth.

Telephone Books You Should Have

Makes no difference whether you are Manager, Lineman, Trouble Shooter, Engineer, Operator or Office Boy, you need some of these Books. Look the list over and send us your order.

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Contents: Definitions; First Principles; Dial Impulse Senders; Dial Adjustments; Dials, Special Features; Dial Interchangeable Crown Wheel; Telephone Instruments; Strowger System of Automatic Telephone Manufacturing Co.
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Chapter headings: I—Wire and Radio Telephone Systems. II—High Frequency Currents and Their Production. III—Vacuum Tubes. IV—Vacuum Tube Oscillators. V—Modulator Systems. VI—Receiving Equipment. VII—Transmission. VIII—Miscellaneous. IX—Super-regenerative System.

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The purpose of this book is to give a thoroughly practical and complete course of instruction in the operation, installation and maintenance of telephone instruments in so far as they relate to private lines and telephone exchanges. Handsomely bound in cloth and printed in large type on good paper. Contains one hundred and thirty-four pages, with sixty illustrations.

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C. D. Kinne Assistant Manager of Stromberg-Carlson Kansas City Office

In 1900, when independent telephony was just beginning to find its place in the industry, C. D. Kinne, a thin, rather tall young man, applied for a job with the American Telephone & Telegraph Co. It didn't make very much difference to him what he did as long as it gave him an opportunity to learn the ins and outs of the telephone industry. He was accepted and went to work as a ground man.

Soon, however, he had served his apprenticeship, graduating into the class of lineman. For three years he worked as a lineman for the American Telephone & Telegraph Co., the telegraphic department of the Erie Railroad Co., and the Hudson River Telephone Co. The year spent with the Erie Railroad Co. is the only time since 1900 that Mr. Kinne has not been directly connected with either a telephone operating or manufacturing company.

In 1904 the Utica Home Telephone Co. of New York secured his services as inspector. But after a year the Herkimer County Telephone Co. of Herkimer, N. Y., offered him greater opportunity in the capacity of superintendent. The success of his work at Herkimer so attracted the attention of the Utica Home Telephone Co. and associated companies that they sought and secured his services in 1907. This seemed to be a type of work for which Mr. Kinne was well adapted. He remained with the Utica company for five years which was followed by eight years with the New York Telephone Co. where he was district supervisor of maintenance.

C. D. KINNE,
Assistant Sales Manager, Stromberg-Carlson Kansas City Branch.

It was not, however, until 1920 that he found the work in which he was to excell. Coming to the Stromberg-Carlson Telephone Mfg. Co. as a practical operating telephone man, he sought a position as salesman. So well did he sell himself to his new employers that he was given the entire state of Texas in which to distribute Stromberg-Carlson products. For six years he covered this huge state from north to south and east to west, selling telephones, switchboards and all kinds of material to keep the equipmet in working order.

All the while he was making friends by helping managers and owners with whom he came in contact to solve their problems. The years spent in the operating field served him in good stead and made him not only a good fellow and an able salesman, but also a competent advisor.

About two years ago so many of the companies with which Mr. Kinne had been doing business came into the market for complete new central office equipment or extensive rebuilding of what they were then using that it became impossible for him to adequately take care

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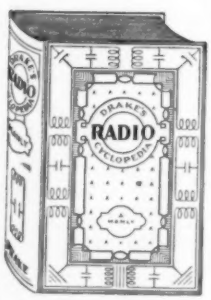

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There is a Prest-O-Lite Torch for every soldering or heating purpose. Telephone and electric light companies everywhere use Prest-O-Lite equipment for lineman's work and in the shop as well. Most of the largest companies have standardized on Prest-O-Lite.

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of the sales possibilities in Texas and still have time to devote to planning new work. Acordingly he was relieved of the responsibility of representing Stromberg-Carlson throughout the state and called into the Kansas City offices as sales engineer. In this capacity he has been able to keep in touch with his old friends and also do much constructive work in recommending new central office equipment. Since 1926 many exchanges have been brought up to the highest standard of telephone efficiency through his efforts.

In recognition of his efforts and ability the Stromberg-Carlson company has recently appointed Mr. Kinne assistant manager of the Kansas City branch. The new position will still allow him to continue to serve the telephone companies of Texas, and his influence will be felt throughout the entire teritory served from Kansas City.

To Manufacture Locust Insulator Pins

W. G. Blackard of Stuart, Va., will begin November 15th the manufacture of locust insulator pins for telephone and power companies. A plant of sufficient capacity to turn out large quantities is installed to serve these industries. For detailed information write W. G. Blackard, Stuart, Va.

A. J. Johnson Issues New Catalog

The A. J. Johnson Electric Company, 217 North Desplaines Street, Chicago, Ill., has just issued a new catalogue, listing the many articles of equipment handled by that firm. In this catalogue you will find listed batteries, pole line hardware, poles, crossarms, pins and brackets, electric soldering irons, bare and insulated wire, switchboard and receiver cords, rubber and friction tape, electrical appliances and the hundred and one things that you will be interested in. A copy of this catalogue may be had by addressing the A. J. Johnson Electric Company, 217 North Desplaines Street, Chicago, Ill.

Missouri Convention Set for November 14th and 15th

Dates for the annual convention of the Missouri Telephone Association have been selected and arrangements made for Wednesday and Thursday, November 14th and 15th, at the Hotel President, Kansas City, Mo. Mark your calendar and be on hand.

Telephonic communication between Madrid, the capital of Spain, and Lisbon, the capital of Portugal, was opened recently.

The city of Athens in Greece has only 1,800 telephone subscribers.

Everything in Readiness for Biggest Convention in History of Independent Association

Preparations have been practically completed for the annual convention of the United States Independent Telephone Association, scheduled for the Hotel Sherman, Chicago, October 16th to 19th, inclusive.

Exhibit space is at a premium and spaces have been allotted to a number of exhibitors in the hallways and on other than the convention floor. Indications point to a record breaking crowd from all parts of the United States, Canada and other countries.

TELEPHONE ENGINEER has not yet been furnished with the program, but it is safe to say that it will be about the best that has been offered a national gathering.

The Pioneer banquet, fostered by the Independent Pioneer Telephone Association, will be the feature gathering of that organization at noon, October 18th. This is an occasion looked forward to by the large gathering of telephone interests.

As usual, reduced rates have been secured on the certificate plan. Consult your ticket agent before buying ticket.

The following exhibitors will display their wares at this convention. All the late improvements in telephone apparatus will be exhibited. You cannot afford to miss seeing these exhibits:

American Electric Co., Inc., 64th and State Streets, Chicago, Ill.; American Steel & Wire Co., 208 South La Salle Street, Chicago, Ill.; Anaconda Copper Mining Co., 111 West Washington Street, Chicago, Ill.; Automatic Electric, Inc., 1027 West Van Buren Street, Chicago, Ill.; Bartlett Mfg. Co., 743 Beaubein Street, Detroit, Mich.; L. M. Berry & Co., Keith Building, Dayton, O.; Lynton T. Block & Co., 511 Locust Street, St. Louis, Mo.; Bowdle Accounting System, Cerro Gordo, Ill.; Carbon Products Co., 11 South La Salle Street, Chicago, Ill.; Chance Co., Centralia, Mo.; Coffey System & Audit Co., Indianapolis, Ind.; Colson Co., Elyria, O.; Cook Electric Co., 2700 Southport Avenue, Chicago, Ill.; Electric Storage Battery Co., Marquette Building, Chicago, Ill.; Everstick Anchor Co., 1622 North 8th Street, St. Louis, Mo.; French Battery Co., Madison, Wis.; Harrah Mfg. Co., Bloomfield, Ind.; Highway Trailer Co., Edgerton, Wis.; Holtzer-Cabot Electric Co., 6161-6165 South State Street, Chicago, Ill.; A. J. Johnson Electric Co., 217 North Desplaines Street, Chicago, Ill.; J. K. Johnston, 903 Lemcke Building, Indianapolis, Ind.; Kellogg Switchboard & Supply Co., 1066 West Adams Street, Chicago, Ill.; Kodel Electric & Mfg. Co., Cincinnati, O.; Leich Electric Co., Genoa, Ill.; National Carbon Co., 27th and Jasper Place, Chicago, Ill.; Page & Hill Co., 814 Plymouth Building, Minneapolis, Minn.; Quick Directory Co., 200 Meridian Life Building, Indianapolis, Ind.; Reliable Electric Co., 3145 Carroll Avenue, Chicago, Ill.; John A. Roebling's Sons Co., 165 West Lake Street, Chicago, Ill.; Runzel-Lenz Electric Mfg. Co., 1751 North Western Avenue, Chicago, Ill.; Sands Electric Co., North Chicago, Ill.; Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.; Templeton, Kenly & Co., 1020 South Central Avenue, Chicago, Ill.; Unique Mfg. Co., 221 West Whiting St., Chicago, Ill.; Buda Co., Harvey, Ill.; North Bros. Mfg. Co., Philadelphia, Pa.; Brown Co., 110 South Dearborn Street, Chicago, Ill. (Mr. H. E. Gunbart); Burroughs Adding Machine Co., 222 West Adams Street, Chicago, Ill. (Mr. Lazendy); Churchill Cabinet Co., 2119 Churchill Street, Chicago, Ill. (Mr. S. T. Gullicksen); Curtin Howe Co., 11 Park Place, New York City (Mr. E. Marshall Taylor); James A. Kearney Corp., 4229 Clayton Avenue, St. Louis, Mo.; Philadelphia Storage Battery Co., 3335 West 47th Street, Chicago, Ill. (Mr. J. N. North); Van Praag Sales Co., 22 East 17th Street, New York (Mr. A. Van Praag); P. Wall Mfg. Supply Co., 3058 Preble Avenue, N. S., Pittsburgh, Pa. (Mr. W. S. Leach).

Pioneer Day at the National Convention

Arrangements are being completed by Secretary J. K. Johnson of the Independent Pioneer Telephone Association for a big program on October 18th at the Hotel Sherman. This day is set apart by the United States Independent Telephone Association for whatever program the Pioneers care to put on.

The committee having in charge the banquet for this occasion has been very active and states that those who attend will be well paid for their time and money.

There has been an increase of more than 100,000 telephones in the city of Detroit in the four years from July 1, 1924, to July 1, 1928.

The state of Tennessee averages about 1,330,000 local telephone calls a day and 11,000 long distance calls.

Approximately 20,400,000 telephones out of the world's total of 29,400,000 on January 1, 1927, were operated by private concerns.

RAY-O-VAC *telephone cells make* lasting friends

Ray-O-Vac cells will stand by you through thick and thin—through the heaviest as well as the lighter drains of telephone service. Under exhaustive scientific tests Ray-O-Vac telephone cells have *proved* their greater recuperative powers and their longer life.

Here is the cell that really cuts replacement costs. And by improving transmission and reducing complaints it helps to build the lasting friendship of subscribers as well.

FRENCH BATTERY COMPANY
Factory: Madison, Wisconsin
Sales Office: 30 N. Michigan Avenue, Chicago
Branches: New York, Chicago, Minneapolis
Kansas City, Atlanta, Los Angeles

FRENCH RAY-O-VAC TELEPHONE CELL

Also Makers of Ray-O-Vac Radio Batteries
Ray-O-Vac Ignition Batteries and
Ray-O-Vac Flashlights and Batteries

With The Manufacturers

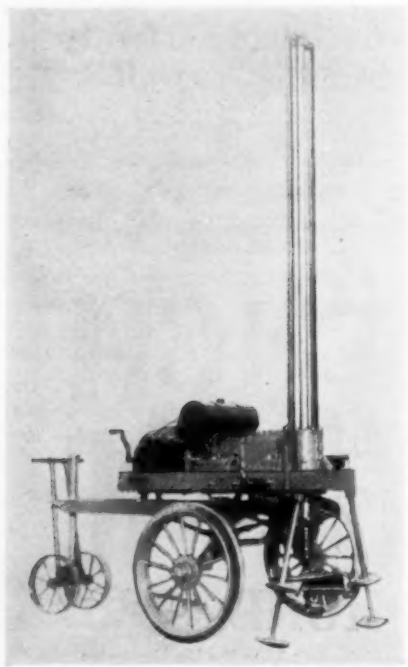
Hole-Digging Costs Greatly Reduced

Great economies in digging holes for telephone poles and for similar purposes are being effected by Buda-Hubron earth drills, according to recent surveys made by the A. C. Nielsen Co., Chicago, covering operations of these machines under various conditions of service.

One survey shows that a tractor-mounted Buda-Hubron drill sunk 54 holes 22 inches in diameter and 7 feet deep in clay and gravel during a 9-hour day. The cost was 45 cents a hole as against $2.70 a hole by hand methods, making a saving of $121.50 a day. This machine is equipped with a pole-setting derrick and was used to erect 120 75-ft. poles in a large city, the work being completed in 24 days at a cost of $565.44 against an estimated cost of $2848.80, a saving of $2283.36.

In the first 44 days of operation of a truck-mounted Buda-Hubron drill, a saving of more than $700.00 was made over former hand methods of sinking holes. This machine is operated by one man and a helper, and does all small work in a district 90 by 125 miles in extent. Nearly half the time is spent in transit to and from jobs, but the machine nets a return of 147% on the first cost of the outfit.

Another survey shows that a trailer type of Buda-Hubron drill is saving $1.60 per hole over hand digging. This machine is operating in an extremely hilly country and works in all formations except hard rock, the boring bar being replaced by a rock drill for drilling blasting holes.



Buda-Hubron Earth Drill Arranged for Mounting on Platform of Auto-Truck

These remarkable performance records are the result not only of the basic design of Buda-Hubron earth drills but of many new features that simplify and safeguard their operation, thereby reducing maintenance costs to a minimum.

The whole machine is rigidly constructed to resist the shocks delivered by the engine, the rating of which is considerably larger than that formerly used. The frame is made of 5-inch steel channels which are strongly braced and securely riveted, and all parts of the drill head are assembled in one unit, thereby insuring perfect alignment. Large clutches carried on spline shafts and operated by ball-bearing throwouts are provided to withstand the heavy shock loads encountered in earth-drilling service. All drive shafts are mounted on ball bearings, and the rubber-tired wheels are equipped with Timken roller bearings.

An improved type of lifting mechanism is provided, two roller chains being used for lifting the dirt from the hole. A chain is located on each side of the spindle, and the chains are suspended between springs so that each carries its share of the load. Chains have many advantages over ordinary solid rack bars, the most important being their self-cleaning feature. No mud or dirt can lodge in them, whereas with racks the dirt gets between the teeth and causes excessive wear. All gears are of exceptionally large size, fully enclosed and running in a bath of oil, making them dustproof.

The controls are simple and easy to operate, and the clutches can be adjusted readily. To feed the drill into the ground the operator only has to move a bar up and down in the same manner that a jack is operated. When a load of dirt is raised from the hole by the drill, the latter is automatically stopped and locked after it reaches its highest possible position. The lifting clutch is automatically released and a band brake engaged so the drill cannot overtravel and hit the drill head; neither can it drop back into the hole.

This type of drill is made for all kinds of soil conditions, and will dig through frozen earth, hardpan, shale and other hard materials. Holes as large as 24 inches in diameter can be drilled 10 feet in depth, though greater depths can be obtained by making a few alterations of the standard design. Drills 1¾ inches in diameter can be supplied for drilling blast holes in hard rock.

Three types of Buda-Hubron drills are available. The trailer type is made for towing, and the truck type is made for mounting on any standard auto-truck. Each of these types is a complete self-contained unit, being powered with a two-cylinder, opposed-type, air-cooled, four-cycle engine provided with force-feed lubrication.

The tractor type consists of a tractor with an extended frame on which the drilling mechanism is mounted. The wheel base is 108 inches, and wheels with solid rubber tires and extended rims are provided so that the machine will travel on cross-country right-of-way as well as on highways. The hole-digging mechanism is mounted on the front end so the drill can be spotted in any location and perpendicular holes can be drilled on the sides of banks or uneven ground. Power is furnished to the drill by means of a belt, which makes an ideal drive for the severe service usually encountered. A pole-raising winch is mounted on the front of the tractor directly behind the drilling mechanism, and is of the worm-gear type, power being used both for raising and lowering the load. The derrick, which is mounted above the rear axle of the tractor, is made of tubular steel sections, and the boom is 28 feet long, although an extra 10-ft. section can be added if desired. The derrick can be used for raising poles as long as 75 feet, or for handling transformers and other loads as heavy as 2½ tons. This particular type was designed and built in conjunction with a large mid-west utility company, and has been thoroughly tested to prove its efficiency in pole-line work.

Buda-Hubron earth drills are manufactured by The Buda Company, Harvey, Ill., from whom complete specifications as well as copies of the surveys covering the exceptional performance records of these machines can be obtained.

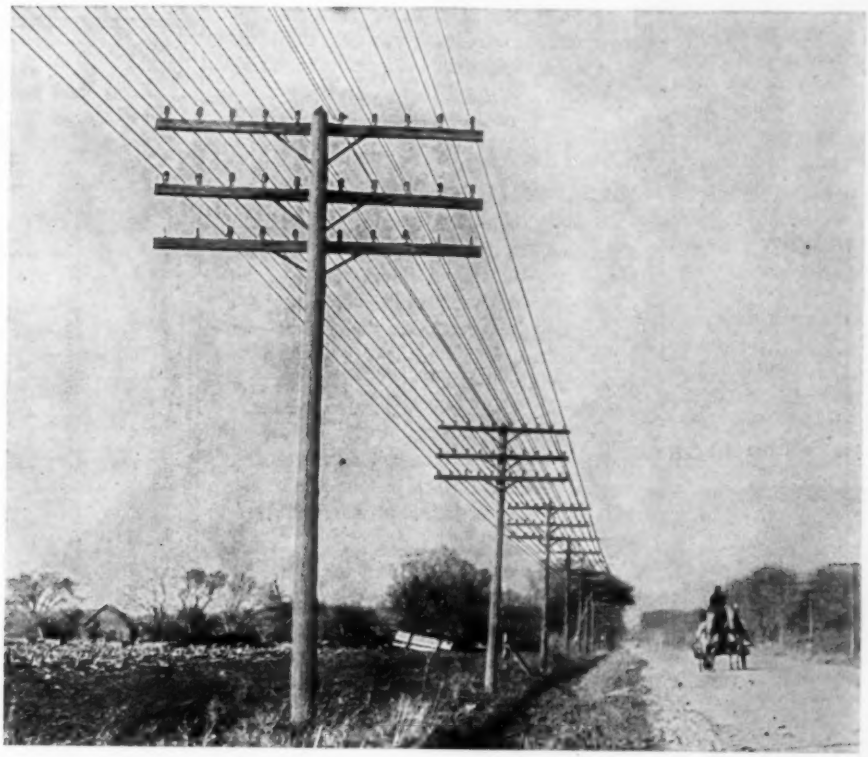
Ready Pay-Out Reels in Demand

A letter from the Ready Manufacturing Company, Security Bank building, Toledo, Ohio, states that business has been very good the past year, for which they want to thank TELEPHONE ENGINEER readers and others. They are prepared to produce the pay-out reels more rapidly, make them better and deliver them quicker.

Telephone and telegraph construction gangs will find the No. 4-A pay-out reel especially convenient because as many as ten or twelve can be placed on a frame on the truck and that number of wires fed out at one time.

They are made of all iron and steel, hence very little depreciation as they last almost a lifetime. Engineering departments for telephone, telegraph, power and light and interurban railway companies are realizing more clearly every day the many uses to which this equipment can be put.

Time-Tested – Why Experiment?



Northern White Cedar Poles in toll circuit lines of Home Telephone Co., Joplin, Mo., set in 1905.

Experienced Users Prefer Them

THE preference that experienced pole users are giving Northern White Cedar Poles proves that they have met the test of actual service.

Because of their light weight for easy handling, great strength, large butts for solid anchorage, and long life, pole buyers everywhere recognize them as an important factor in keeping maintenance costs at a minimum.

You can cut gains and put on new cross arms at any time without exposing pole to decay.

Northern White Cedar Association

Minneapolis - Minnesota

Northern White Cedar Poles

P. A. Terrell Now With Copperweld Steel

On October 1st last, P. A. Terrell, formerly manager of the New Industries Division of the Mississippi Power Company, took charge of central stations and railroad sales for the Copperweld Steel Company, makers of electrical rod, wire and strand products which consist of a core of steel around which has been molten welded a heavy exterior of copper. Mr. Terrell's appointment brings to the states of Tennessee, Mississippi, Alabama, Georgia and Florida, the usual Copperweld engineering service on such problems as sag, tension, etc.

Mr. Terrell was graduated from the Alabama Polytechnic Institute, Electrical Engineering, in 1917. The following nine months was spent on the General Electric test course at Schenectady. He served as lieutenant, 158th Company, First Regiment of United States Marine Corps,

P. A. Terrell

Southern Representative of Copperweld Steel Co.

seeing active service in Cuba and Haiti. Following his military service he was employed by the Alabama Power Company in the line and substation maintenance department, becoming the assistant superintendent of the West Division in 1920. In 1921 he was then promoted to superintendent of the Gadsden District and became district manager of the Jasper District in 1922. Mr. Terrell resigned this position in May, 1927, to become manager of the New Industries Division of the Mississippi Power Company, which position he has held until his association with the Copperweld Steel Company.

Standard Underground Cable Company Issues New Catalogue

The Standard Underground Cable Company, Pittsburgh, Pa., has just issued a new catalogue describing Outdoor Cable Terminals manufactured by that concern. This catalogue is one of the most complete issued by this concern, covering every phase of outdoor cable accessories and construction. The catalogue contains 136 pages and cover, with hundreds of illustrations, blueprints, etc., showing sizes, styles, terminal stations, etc., with instructions for installing outdoor terminal cables.

This catalogue should be in your files if you expect to do any cable construction work the coming year, and it is yours for the asking. Address the Standard Underground Cable Company, Pittsburgh, Pa., asking for Bulletin No. 701.

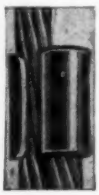
More than 1,000,000 telephone calls a day are made in Greater Kansas City.

Telephone service between Great Britain and the Grand Duchy of Luxemburg was recently opened.

Unassembled Connector

BRIDGING twisted pair to twisted pair, a practical application of the Kearney Solderless Service Connector.

FOR Telephone Lines in making party line taps, order Catalog No. 86. The tap can't slacken off. This connector is for No. 12 wire or smaller.



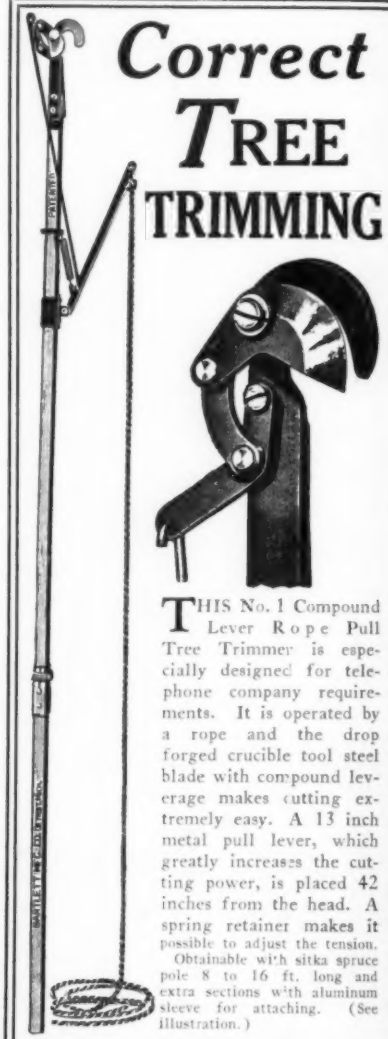
ASK ABOUT KEARNEY CERTIFIED MALLEABLE SCREW TYPE ANCHORS

Kearney Guy Wire Serving Clips. Eliminate Serving End of Strand. Made of Aluminum, Copper, and Galvanized Iron.

JAMES R. KEARNEY ST. LOUIS, MO.

4226M Clayton Ave.

Correct TREE TRIMMING



THIS No. 1 Compound Lever Rope Pull Tree Trimmer is especially designed for telephone company requirements. It is operated by a rope and the drop forged crucible tool steel blade with compound leverage makes cutting extremely easy. A 13 inch metal pull lever, which greatly increases the cutting power, is placed 42 inches from the head. A spring retainer makes it possible to adjust the tension. Obtainable with sitka spruce pole 8 to 16 ft. long and extra sections with aluminum sleeve for attaching. (See illustration.)

BARTLETT MFG. CO.

452 East Lafayette Ave. Detroit, Michigan

Famous Box of Six Color

HOLIDAY STATIONERY $3.00 PREPAID

Size of sheet 8⅜" x 10⅞"
With No. 9 Envelopes to match stock. 50 Sheets and 50 Envelopes.

Sheets Beautifully Lithographed Six Colors on Navarra Text Stock, Color Cream. Complete with name, street address, city and state. Envelopes plain and made of same stock.

ORDER BY MAIL

Shipped anywhere in the United States, fully prepaid.
Send Check, Money Order, Currency or Stamps. Currency and Stamps must be sent by registered mail.

Interesting prices quoted on Business Letterheads, Lithographed or Three-Color Work—Send for Samples.

B. T. SHERK

Ogden Building Chicago, Illinois

New Guaranteed

¼ h. p., A. C., 110v., 60-cycle, 1-phase, double shaft

MOTORS

complete with emery and buffing wheels

$15.00

F. O. B. Chicago

Used Drop Wire $25.00 Per Ton

W. M. Miller & Sons

2553 Madison St., Chicago, Ill.

SCRAP PLATINUM

Highest prices paid for discarded or obsolete telephone and switchboard apparatus; platinum contact relays, ring keys, etc. Have specialized in this field for many years.

CONTACT METALS CO.
2500 S. Wabash Ave., Chicago

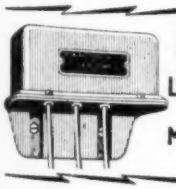
Make Your Directory a Source of Income
Write for Particulars
J. H. WELKER
McKinley Block, Canton, O.
Telephone 8009
DIRECTORY ADVERTISING EXCLUSIVELY

J. G. WRAY & CO.
Telephone Engineers
Specialists in Appraisals, Rate Survey, Financial Investigations, Organizatio and Operation of Telephone Companie
J. G. Wray, Fellow A. I. E. E.
Cyrus G. Hill
Rm. 2130 Bankers Bldg., Chicago

J.K. Johnston, Telephone Engineer
During recent years I have been privileged to appraise Telephone Exchanges all over the United States The list totals 663. Would you like to avail yourself of my services?
903-4 Lemcke Building, INDIANAPOLIS

EARL L. CARTER
CONSULTING ENGINEER
613 Merchants Bank Bldg. Indianapolis, Ind
Special attention given to all matters pertaining to Valuations and Investigation of Public Utility Properties.
Formerly Chief Engineer, Public Service Commission of Indiana

ACCOUNTING
Specialization on Public Utility Accounting Records and Audits enables us to best serve Telephone Companies.
HERDRICH AND BOGGS
Certified Public Accountants
1014 Merchants Bank Bldg., Indianapolis, Ind


CHAPMAN
LIGHTNING ARRESTERS
MADE BY
MINNESOTA ELECTRIC CO
MINNEAPOLIS, MINN.

Phone Adams 5646
Snook, Martin & Co.
Consulting Engineers
40 WEST GAY STREET
COLUMBUS, O.
Make Use of Our Combined Century of Engineering Experience

Telephone Notes

Alabama—Public Service Commission, Montgomery, granted South Central Telephone Co. permission to acquire telephone systems in Beatrice, Wadley, Eva, Falykville, Vinemont, Fairview, Cullman County, Camden, Blountsville, Canoe, Hodges, Jones Mill, Luverne, Orrville, Repton, Rockford, Rogersville, Vina and Wedowee.

Ark., Little Rock—Southwestern Bell Telephone Co., St. Louis, Mo., construct exchange at Elm and Woodlawn avenues; 1½ story, 85x72 ft., smooth face brick, tile roof, cut stone trimmings; install $300,000 dial telephone equipment.

D. C., Washington — Chesapeake & Potomac Telephone Co. board of directors authorized expenditure of $137,000 for extensions and improvements to telephone system in Washington; improvements include placing additional underground cable and conduit in Main, Franklin, Cleveland, Georgia and Central office areas; about 20,000 ft. of underground conduit and 70,000 ft. cable.

La., Monroe—Southern Bell Telephone & Telegraph Co., Atlanta, Ga., expending $70,000 for extension of cables to serve Monroe and West Monroe.

Md., Frederick—Chesapeake & Potomac Telephone Co., 5 Light street, Baltimore, authorized $20,600 expenditure for additional telephone repeaters or booster equipment.

N. C., Greensboro—Southern Bell Telephone & Telegraph Co., Atlanta, Ga., J. E. Warren, general commercial manager, reported considering erection of telephone building within next year at Eugene and Sycamore streets.

Oklahoma — State Corporation Commission, Oklahoma City, granted permission to Oklahoma Associated Telephone Co. to acquire telephone exchanges at Agra, Billings, Carney, Coyle, Glencoe, Marland, Morrison, Mulhall, Perkins, Ripley and Yale.

Tex., Austin—Southwestern Bell Telephone Co., main office, St. Louis, Mo., contemplates constructing addition to telephone building.

Virginia — Inter - Mountain Telephone Co., Johnson City, Tenn., acquired properties of Wythe Mutual Telephone Co. at Wytheville, Max Meadows, Ivanhoe and Laswell, with connecting companies at Bland, Rural Retreat and Ceres; plans $25,000 improvements, including central office equipment, operating room and commercial office.

Va., Roanoke—Chesapeake & Potomac Telephone Co. of Virginia, Richmond, N. O. Wood, manager, plans expending $138,478 for additional facilities in Roanoke and outlying districts; install 9,000 ft. of underground conduits, manholes, 10,000 ft. aerial cable, toll entrance cable on Roanoke-Lynchburg line; pole replacements on Roanoke-Staunton, Roanoke-Peterstown, Radford-Cumberland Gap

Creed of the Safety Man

I believe that the greatest satisfaction in life is to do good work.

I believe that work is not well done unless it is safely done.

I believe in putting into practice the things I believe, so that my example may cause others to adopt the safe and careful way in pursuing their daily work and thereby lessen the number of avoidable accidents.

I believe in giving a new man the glad hand and showing him that he's joining up with a bunch of regular fellows. He'll appreciate it and you can bet your bottom dollar that he'll then put his shoulder to the wheel and help us make this the safest plant of its kind in the country.

I believe it's easier to do a job safely than to explain why I took a chance.

I believe that it takes more time to report an accident than it does to prevent one.

I believe that if your helper sees that you always work safely he will do the same.

I believe this is a good old world for the man who works safely.

I believe that safety comes not from wishing and hoping, but from thinking and doing.—Safety Committee, Frank X. Staub, Chairman. Home 'Phone News, Home Telephone & Telegraph Company, Fort Wayne, Ind.

When Writing Advertisers Speak a Good Word for TELEPHONE ENGINEER

OPERATORS' BREAST PLATE SETS

S. C. white enameled breast plate operator's sets complete	$5.00
S. C. No. 23 plugs for same	.35
New mouthpieces for same	.50
S. C. No. 20 operators' receivers and head band	2.00
Kellogg S. and S. Co. No. 1076 operators' breast plate sets complete	5.00
S. C. and Kellogg jacks for above sets	.35

BUCKEYE TELEPHONE and SUPPLY CO.
COLUMBUS, OHIO

Phone Company Builds Line to English, Texas

Clarksville, Texas.—The Two States Telephone Company is building a line into English, 12 miles east. Ten lead wires are to be extended to this place, it is understood. Extensive improvements have been made by the Two States company here during the last few months.

FOR SALE.

50 Dean Wall Sets three and four bar, 1,000 ohm Ringer at $175, 25 Kellogg Wall three bar, 1,000 ohm Ringer at $2.75, 25 Kellogg three and four bar Desk Stand Boxes, 1,000 ohm Ringer Dean Stands with Kellogg transmitter at $2.50. The above phones are all in working order.

One 20-line Stromberg-Carlson PBX Common Battery Switchboard equipped for 20 lines, cabinet in good condition, at $30; one 300-line Reliable Distributing Frame at $25; 4 banks, 20 per strip No. 10 Cook Protectors at $5 per strip; 34 Baird Coin Boxes, 1 slot, takes 5, 10 and 25 cent coins, $1; 5 one slot gray Coin Boxes, $1.

300 Kellogg Harmonic Ringers, cycles 16⅔, 33⅓, 50 and 66⅔ at 50c; Ringing Machines, one No. 6 Kellogg, two No. 7 Leich, two 84 W. E. Co. at $15 each; one Kellogg Power Board with meters at $25.

Eight No. 7815 Dean Phanton Coils, four No. 13A Kellogg Coils, 28 No. 15A Kellogg Repeating Coils at 50c each; 8 No. 7A Kellogg Induction Coils, 25c each; 2 strips of W. E. Co. drops, No. 34B 20 per strip with mountings, $15; 2 strips of W. E. Co. drops, No. 34J 10 per strip with mountings, $15.

Denver and Eohrata Telephone and Telegraph Company, C. E. Eaby, Mgr., Ephrata, Pa.

RECONSTRUCTED EQUIPMENT

Stromberg-Carlson No. 599 4-bar 1000 or 1600 ohm Bdg. compact type wall telephones, with Western Elec. Transmitters @	$ 6.90
Stromberg-Carlson No. 992 type 4-bar 1000 or 1600 ohm Bdg. desk sets @	10.50
Kellogg No. 2696 type 4-bar 1000 or 1600 ohm Bdg. compacts $7.75—4-bar @	8.50
Kellogg No. 28 desk sets with new Cabinet inside connection rebuilt signal set, 3-bar 1000 ohm $10.00—4-bar @	10.75
Western Elec. No. 20 desk set with W. E. Trans. & Rec. complete with 3-bar 1000 or 1600 ohm exposed post signal sets @	9.50
Western Elec. No. 20 desk set with W. E. Trans. & Rec. with new Cabinet inside connection Rebuilt Signal set, 3-bar 1000 or 1600 ohm @ $10.50—4-bar @	11.00
Dean C. B. Steel hotel sets (Balance coil type) equipped with straight line or Harmonic ringers @	3.75
Kellogg No. 17 Repeating coils @	2.75
American Elec. No. 36 type 4-bar 1000 or 1600 ohm Bdg. compacts equipped with Kellogg or Western Elec. Transmitters @	6.25
American Elec. No. 360 Pony type 3-bar 1000 or 1600 ohm Bdg. compacts with Western Elec. or Kellogg Transmitters @ $6.75—4-bar @	7.25
Monarch 3-bar 1000 or 1600 ohm Bdg. compacts @ $6.75—4-bar @	7.25
No. 19 single Conductor inside Rubber covered telephone wire, per 1000 feet @	3.25

Write for Our Bulletin

REBUILT ELECTRIC EQUIPMENT CO.
Not Inc.
1940 W. 21st St., Chicago

Fort Wayne Acts to Stop Free Service

The Home Telephone & Telegraph Company of Fort Wayne, Ind., is planning to convert all flat rate telephones, offered free to the public, in Fort Wayne business places, into semi-public pay stations, it was announced by B. C. Schweitzer, commercial superintendent.

The Fort Wayne company has ordered 300 lines of this equipment and plans to cut all of them into service just prior to issuing the December 1 directory.

The classes of business approached in the campaign are drug stores, cigar stores, bowling alleys, pool rooms, restaurants, delicatessens, soft drink parlors and some groceries.

WANTED—Good combination inspector and troubleman who has had experience on cable trouble. Permanent position for good all around man. Address "Troubleman," care TELEPHONE ENGINEER, 192 N. Clark St., Chicago.

FOR SALE

Stromberg Carlson 2 conductor S-22F cords with No. 56 G plugs @ 50c.
Stromberg Carlson 4 bar 1600 short type wall telephones, $8.50.
Leich 7A ringing machines, operates from 110 volt A. C. current, $40.00.

TELEPHONE REPAIR SHOP
6966 Ravenswood Avenue
Chicago, Illinois

UNIQUE BLOW TORCH

It starts quickly, operates in any position, and produces a remarkable heat. It is a great worker in cold and windy weather.

The automatic orifice cleaner, one of the details shown in the illustration, is but one of a number of exclusive features that make the Unique your greatest value in blow torches.

Painstaking care by interested workmen, an actual "burning test" before shipping, is just another detail responsible for their uniformity and efficient burning qualities.

Write for complete details

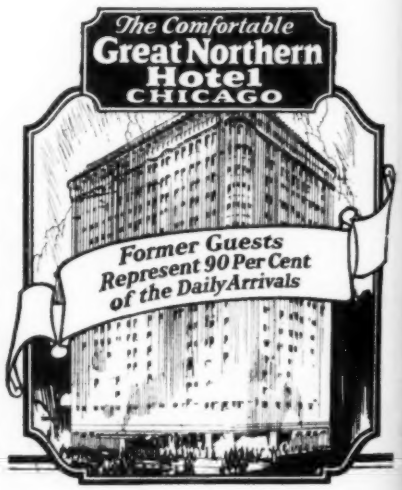
Unique Manufacturing Co.
221 Whiting St. CHICAGO, ILL.

PEARL LIFE-TIME DROP WIRE BRACKETS
Save time, labor and waste. Hot-galvanized screw-hooks and malleable castings are separable and indestructible. Standard 2 groove porcelain. Stocked by telephone manufacturers.
WM. H. PEARL CO., Indianapolis

Send for free sample and prices on
UNIVERSAL DROP WIRE INSULATORS
Universal Specialty Company
711 Poplar St., Terre Haute, Ind.

Get your
Telephone Repair Work
done at the old reliable
Telephone Repair Shop
SUTTLE EQUIPMENT CO.
LAWRENCEVILLE, ILL.

The Comfortable
Great Northern Hotel
CHICAGO



TRAVELERS select the Great Northern for its wonderful location in Chicago's "loop". They return because the large comfortable rooms, homelike environment, attentive service, excellent food and moderate charges make it an ideal hotel.

400 Newly Furnished Rooms
$2.50 a day and up

Sample Rooms
$4.00, $5.00, $6.00
$7.00 and $8.00

WALTER CRAIGHEAD
Manager

Dearborn St. from Jackson to Quincy
New Garage One-Half Block